

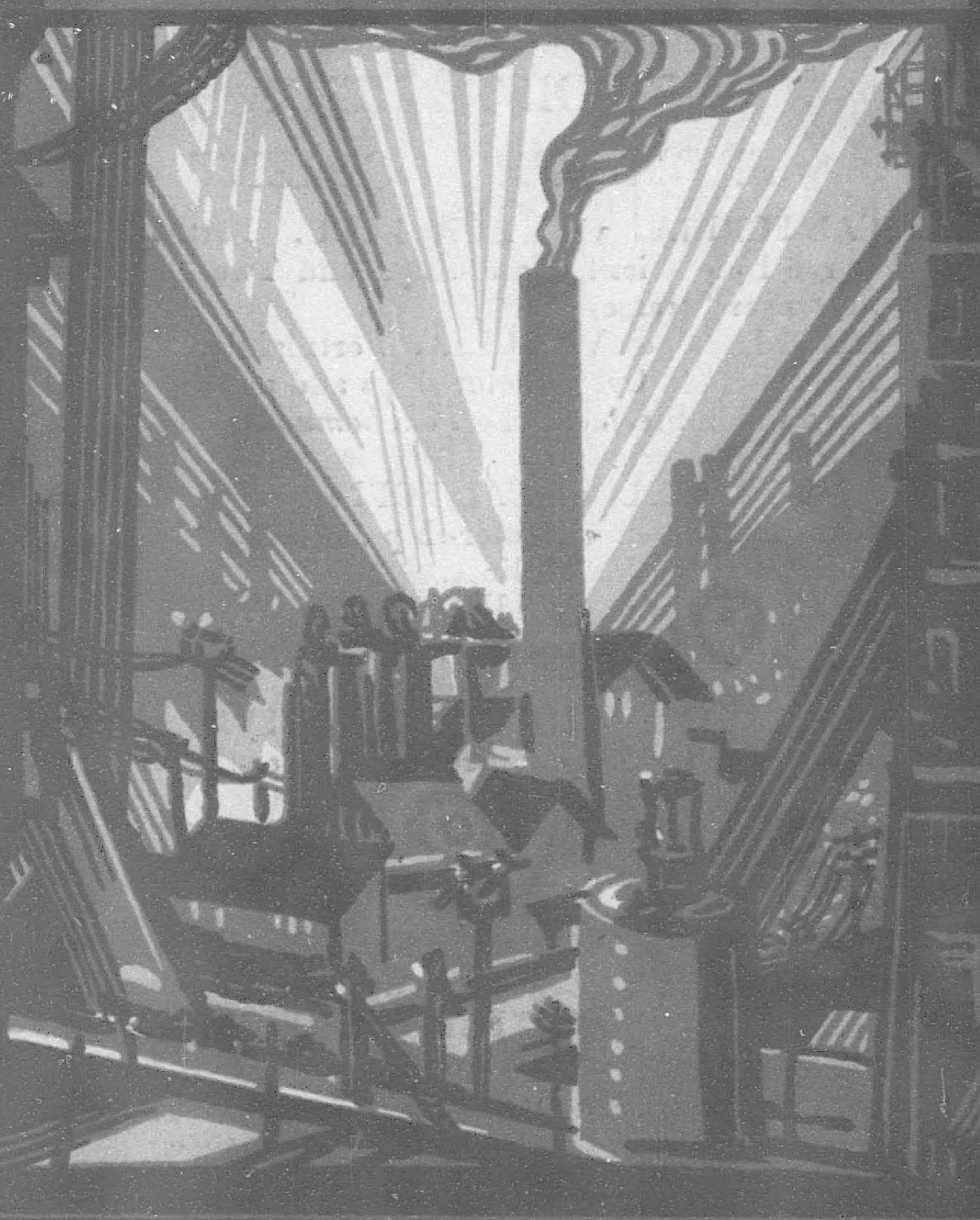
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# THE FAR EASTERN REVIEW



DEBUNKING THE OPEN DOOR  
POLICY

THE DOOR TO MANCHURIA  
THE TRAGIC ENDING TO A DALY  
OPERA

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# The Far Eastern Review

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## Debunking the Open Door Policy

Americans do not require a Fleet to Guard the Entrance, but a Competent and Willing Policeman on the Inside of the Door to Assist Them to Get Out

A Little More Attention to the Exit, Mr. Stimson!

By GEORGE BRONSON REA

WILL the United States go to war in the Far East? Are we headed towards the conflict that will destroy our commerce in the Pacific, bankrupt Japan, set her back for a generation and hand over to Europe the trade and development of China? Secretary Stimson's notes and open letter to Senator Borah constitute an emphatic redeclaration of the established policy of the United States to maintain the integrity of China and to insist on the "open door" principles as now embraced in the clauses of the Nine Power Treaty. Mr. Stimson makes it clear that the United States will stand by that policy, even though it becomes necessary to scrap the Disarmament Treaty and build up such a navy with bases in the Pacific that the future integrity of China will be safeguarded. In unmistakable English, Mr. Stimson warns Japan that the United States will uphold its conception of the Open Door, a warning that becomes a threat when he adds that the United States will not recognize any change in the *status quo* in the Far East which may be brought about by force.

The American people are nearing the end of a thirty year diplomatic farce and unless we are extremely careful, the nation may be called upon to fight in order to uphold a policy conceived and promulgated in blissful ignorance of conditions as they existed. For had John Hay (or any other honorable American statesman) known of the existence of the secret treaty of alliance between China and Russia signed in May 1896 and aimed at Japan, he would never have issued his invitation to the Powers to subscribe to the doctrine that now bears his name. Had Theodore Roosevelt even suspected that this treaty had been signed, he would never have urged upon Japan the peace that tricked her out of a legitimate indemnity.

It is time for Americans to speak plainly to each other. We may be called upon at any time to make good on our threats. Secretary Stimson's notes tell us that some day we may have to fight Japan. It may be that this war will be delayed until the strategic situation in the Pacific is more in our favor, but this means placing the whole case before Congress and the people in order to extract the appropriations necessary for increasing the fleet and fortifying the Philippines. It is high time that Congress and the people of the United States demanded a clarification of policies

imposed upon the nation by a group of idealists who would involve the country in war to enforce their viewpoint. Had a Congressional investigation been conducted twelve years ago into the conspiracy that so nearly precipitated the nation into war with Japan at that time, the atmosphere would have been clarified and the truth brought home to the people of the country.

### The Open Road to War

We are again facing the climax to the same sentimental program and it is squarely the duty of Congress to assert itself in a matter that the administration is co-operating with the League to solve. It is too early to predict what the report and recommendations of the League Commission now in China will bind us to. Conciliation may fail. No solution that restores Manchuria to the *status-quo-ante* September 18 will be acceptable to Japan and we may have to use force, either direct or through the boycott, to compel Japan to accept our verdict. We cannot sidestep the issue that is being forced upon the nation by our association with the League. If the State Department either alone or in co-operation with the League of Nations adheres to a policy that rejects the right of Japan to defend her national existence in Manchuria, insists upon its conception of the Open Door in these regions and refuses to recognize any change in the *status quo* when brought about by Japan while acquiescing in the aggressions of Russia which compel Japan to protect herself while there is yet time, the United States must support its diplomacy by force. We must go to war in the Pacific to uphold our right to intervene in the affairs of China and continue in business as an eleemosynary institution. For, stripped of all superfluous verbiage, diplomatic phraseology and Colonel Sellers trade propaganda, the Open Door Doctrine in China reduces itself to our right to give away money.

Let us strike a balance sheet of our trade with China and see what the Open Door means to us. We sell annually \$100,000,000 worth of American products to China. The figures vary from year to year according to the exchange or volume of trade, but the

above average is a fair one. We purchase from China somewhat less than we sell. Now it is our exports to China that enter solely into our conception of the "open door;" the right to sell our oil, tobacco, machinery, automobiles, raw cotton, dyes, timber, etc. We would never go to war to uphold our right to purchase Chinese produce that in the main competes with the labor of our own farmers, such as low grade wool, eggs, peanuts, hides, bean oil, wood oil, sausage casings, etc. Should Washington suggest that the Open Door had any connection, however slight, with our right to equal opportunity in the purchase of these Chinese agricultural products it would hear from the farmers of America a more emphatic and menacing protest than it ever received from the evangelical and educational group that for years has dictated our policies towards China. No, it is fair to assume that we will never fight for our right to equal opportunity to import the agricultural produce of China which competes with our farmers in their own home market.

The Open Door means, if it means anything at all, equal opportunity to sell American products to China. As we may have to go to war to enforce this policy, we ought to know just what it means to us in dollars and cents. Of course, we may fight for a principle, even though it carries no immediate pecuniary advantage with it. However, it is just as well, to be practical and see what the principle means to our national economy.

### Down to the Facts

Let us analyze roughly our \$100,000,000 export trade with China, which we hope to expand to the point where the profits will repay us for our past philanthropies and future outlay in armaments. In the first place, just about half the trade represents oil and tobacco. Take the 1930 returns as a fair example. The value of our total exports to China (including Hongkong) for that year was \$112,192,000, of which \$45,000,000 represented oil and tobacco. Practically all of this trade is controlled and handled by American firms, a natural monopoly that no competitor can take away from us for the present. However, we must not overlook the fact that the Soviet is dumping oil in the Far Eastern markets and China can grow all her own tobacco as soon as law and order is assured. We may or may not hold our supremacy in these major trade items as the years roll by. A little extra duty on imported leaf and a prohibitive tariff on cigarettes can deprive us overnight of a trade that is now worth roughly \$20,000,000 to our Virginia and North Carolina tobacco growers. A closer understanding between Nanking and Moscow (always a possibility) would mean a wallop to our \$30,000,000 oil business. In other words, we have no guarantee even under the "open door" that we will hold our supremacy in the sale of these products to China. We certainly would not go to war to compel the Chinese Government to forego its sovereign right to apply prohibitive tariffs on a luxury like tobacco or create a state monopoly to manufacture and sell its products. Nor would the nation become bellicose over the possibility of losing the China market for kerosene, gasoline and lubricating oils when, in view of our dwindling oil resources, these supplies may be needed for home consumption.

What then remains for us to fight over? Cotton? In 1930 we exported to China about \$24,000,000 worth of raw cotton but at least sixty per cent went to the Japanese mills in this country while probably seventy-five per cent was purchased and shipped direct through Japanese firms. China also produces cotton and under any guarantees of law and order, can supply her own requirements in the lower grades. With proper selection of seed and improved methods of cultivation she may also in time raise the longer staple variety.

What is left for us to get excited over? Automobiles? In 1930 we sold 1,867 automobiles to China (including Hongkong) valued at about \$1,600,000. This market is capable of great expansion as roads are built and kept in repair. It is interesting for Americans to understand that in this connection 1,795 automobiles were imported into China Proper from Japan in 1930, valued at \$1,196,000. Japan sold 463 more automobiles to China Proper than we did and received in payment \$514,000 less than we did for our 1,332. At this rate, someday the Japanese may freeze us out of the automobile market in China. The Japanese do make a few automobiles under heavy subsidy for their army and government purposes, but the automobiles they export to China are the

products of the General Motors factory at Osaka and the Ford plant at Yokohama. Instead of taking our profits with our right hand and giving employment to American workmen, we prefer to take them with our left hand and give a little employment to the Japanese in assembling such parts we ship out to them. The Japanese exports of automobiles and trucks to China must therefore be classed as sixty to seventy per cent American business. Unless this fact is brought home to the American people and hammered in, they will be told that the Japanese are taking their markets away from them in China and closing the door to their automotive trade in Manchuria.

What more is there? Machinery? In 1930, we sold about \$8,000,000 worth of machinery to China and about \$7,500,000 of steel. Here we have a total of \$86,000,000 in the major items of our export trade with China; oil, tobacco, raw cotton, automobiles, machinery and steel, leaving a balance of \$26,000,000 to account for the many other lines of muck and truck, dyes, milk, wheat, lumber, etc.

### Where the Losses Come In

Now if we ever fight to uphold our conception of the "open door" it will be against Japan. We will not fight our good friend Russia, or Great Britain or France, but we will get hostile with Japan. Secretary Stimson tells us we must get ready for that conflict. But before we fight let us try to understand what it is all about. We have seen that approximately one half our trade with China is in oil and tobacco, an American monopoly. Now the Japanese have invested upwards of \$500,000,000 gold in railways, mines, cotton mills, and industrial enterprises in China. Like similar plants in America, they consume annually an average of ten per cent on their valuation in repairs, extensions, spare parts, supplies, oil, etc. Japan therefore has created a natural engineering market of her own in China valued at \$50,000,000 a year, exclusive of the raw materials consumed in the manufacturing plants. The Japanese naturally place the orders for these requirements through their own firms and as far as possible the purchases are made in Japan. But there are many items that Japan cannot supply and to a large extent these orders are placed in the United States. An analysis of China's import trade for 1930, will indicate that at least \$30,000,000 of American exports to China were destined for these Japanese enterprises, and 1930 was an off-year. It has gone up to nearly \$50,000,000 in previous years. Excluding oil and tobacco, the Japanese purchases in the United States destined for their own consumption in China accounts for about fifty per cent of the remainder of our 1930 trade or roughly 27 per cent of the total. When the Chinese boycott Japanese products it has no appreciable effect on these direct Japanese purchases in America but when America boycotts Japan, we automatically lose a thirty to fifty million dollar market in China that we cannot by any possible chance make up through Chinese friendship. There is no friendship in Chinese business, or any other business for that matter, and the open door means that the orders will go to the nation that will quote the lowest prices and extend the longest credits, especially the latter.

What is a fair profit from this \$100,000,000 export trade? Let us put it at ten per cent though outside of oil and tobacco it would be difficult to find an American firm in China that is not deeply in the red. If some of them could collect the money owing to them for materials supplied in the past ten years to the Chinese Government they would call it a day and retire. Most of them are in so deep that they are compelled to hang on, hoping for better days. But let us suppose that we are paid cash for all our exports and place our profits at the comfortable figure of ten per cent, or a \$10,000,000 addition to the national economy. Of course, we make something from our imports of Chinese products, but it would be unwise to over-emphasize this item and call the attention of our farmers to what they are up against with Chinese competition. We can depend upon Congress to take care of this phase of the "open door" as soon as the farmer gets wise and lets out a yell for protection.

### Just Giving it Away

Now let us look at the other side of the balance sheet. It is officially admitted that upwards of \$15,000,000 a year are con-

tributed by the American people for carrying on missionary, educational and general uplift work in China. This, of course, has no relation to trade but is rather an expression of our philanthropic interest in the country. But it shows that for every dollar of profit we make through our exports to China we hand back one and a half dollars in charity. In reality, it is nearer two for one. There are about four thousand American businessmen in China trying hard to build up American trade and there are, or were, three years ago, eight thousand missionaries, educators and uplifters engaged in returning the profits from that trade to the Chinese people. The uplifters outnumber the merchants two for one, so that when it is said that our chief industry and concern in China is to give away money, the above figures bear it out. It would seem then that the "open door" resolves itself into a determination on our part to insist upon and fight for the right to propagate our religion, our political ideals and to remain in business as a charitable institution.

But that is not all. We know more or less what the profits from our trade with China ought to be, whether we make them or not. But we do not know how much the Chinese in America profit from their business with us. We can only hazard a rough estimate. A few years ago the New York Police Department reported over seven hundred Chinese restaurants in Greater New York City alone, whose gross revenue was about \$75,000,000 a year. Now every city in the United States has its Chinese restaurants and its Chinatown, so it is fair to estimate the gross intake from all over the country at four times the New York figures, or \$300,000,000. This does not include the profits from opium and narcotic smuggling, gambling rackets, bootlegging Chinese across the borders and other illegal activities of the *tongs* which precipitate their periodic murderous wars over division of territory and the spoils. The Chinese in the United States probably do a business with an annual turnover of nearly \$500,000,000 or five times the value of America's export trade with China and with corresponding profits. We may never know the total profit extracted by the Chinese from their activities in the United States, but we do know that they remit annually to China the amazing sum of \$25,000,000 gold. Add this to the \$15,000,000 for missionaries and uplift and we have \$40,000,000 of American gold on one side of the national ledger against a problematical \$10,000,000 on the other, an adverse balance of \$30,000,000 a year. This is the balance sheet expressed in dollars and cents, an intelligent analysis of a doctrine that the nation may be called upon to go to war to perpetuate. And this adverse balance with varying annual fluctuations has been running up for more than twenty years. To it, must be added defaulted loans, unpaid bills for materials supplied to the Chinese Government, famine relief contributions and other Red Cross charities which total approximately fifty to sixty millions with accumulated unpaid interest. An audit of our trade and charities with China during the past ten years will probably show that the nation is in the red to the extent of three to four hundred million gold dollars. There is little hope that this picture will materially change in many years. If we now prepare to enforce our conception of the "open door," it will put us back another several hundred million in battleships and fortifications and make it impossible to ever balance the ledger.

### Where the "Open Door" Leads

The "open door" to-day means nothing more than our right to the most favored nation treatment under any treaty that China may negotiate. That refers to trade alone. It does not impair China's exercise of her sovereign prerogatives to create and maintain monopolies nor does it prohibit her from entering into a contract with any one country to finance and construct all her railways or other public utilities. The Nine Power Treaty recognizing China's full sovereignty, deprives us of any right to intervene or protest against any monopolistic contract she may care to enter into with any particular nation. Unless we can enforce upon a sovereign China the principles which underlie the International Financial Consortium, insuring to us equal participation in the financing and supply of materials for new railways, and public utilities, we are hopelessly out of the future development picture of China. It will be many years, if ever, before American bankers will consider the underwriting of an exclusive American loan to China that depends for its protection upon the diplomatic support of the State Depart-

ment. Only the assurance that other Powers will co-operate with the United States to guarantee the faithful observance of the loan agreement will induce American bankers to risk their own or their client's funds in this country. The consortium principle itself is the very negation of the high-sounding principles underlying the Nine Power Treaty, an impairment of China's sovereignty and freedom of action just as harmful in its operation from the Chinese viewpoint as any other infringement of their territorial and administrative integrity. The Consortium principle cannot be enforced except in a negative manner. It can act to prevent loans to China, but China will never recognize or submit to its implied monopoly. Granted that the Consortium could function and finance the construction of thousands of miles of new railways, highways, public works and utilities needed to develop China, there would have to be a hard and fast clause in the loan agreements stipulating that the materials should be purchased in the countries furnishing the funds. Otherwise, if China could use these loans to purchase the materials through open tenders, Germany, Belgium and Luxembourg would walk off with the bulk of the orders for heavy steel and railway requirements.

### Lemons for all Comers

For the past thirty-two years the door of equal opportunity in China has stood wide open for American capital to enter. It has been a little difficult at times to squeeze in, but it was always possible to get through. In this space of time, the British, French, Germans, Belgians, Dutch and Japanese have managed to get inside and do a lot of profitable and in some cases very unprofitable business. We don't hear any of these nations uttering wild threats about going to war over the open door in China. They know that when the opportunity presents and the Chinese Government of the day needs the money, they can obtain any contract or concession they want and almost on their own terms. These nations built railways in China, constructed harbor works and public utilities, developed mines and in other ways staked their bets on the Chinese wheel of fortune. They advanced the money to build the existing system of loan-built railways in order to get the business of supplying the lines with equipment during the life of the loans. They are entitled to the business they have created and it ill becomes Americans to complain about being frozen out of such a market. We had the opportunity to do likewise and build up our own market for American railway and engineering supplies, but we prefer to insist upon our right to equal participation in a trade the other fellow's money has created. We did succeed in breaking into this market during and after the war, and at first rather congratulated ourselves on our success. We got the business, but in nearly every instance, our railway supply manufacturers are still waiting to be paid for the materials delivered. The door was opened for them by the exertions of our Commerce Department. They are inside alright, but how they would like to get out again!

How many miles of railway has American capital built in China? We once built thirty miles of road from Canton to Samshui operated with the second-hand locos that hauled the old steam-driven elevated trains in New York City, but we handed the concession back to China when pressure was brought to bear upon us to sell out and cancel the contract. We participated up to \$7,500,000 in the Hukwang Railway loan, but this was swallowed up in the construction of the British section of the line. We would never have been given even a look-in on this, had not President Taft sent a friendly ultimatum to the Prince Regent insisting upon our right to a slice of what we then thought was a melon. It was, only the letters of the first syllable got jumbled up. It was really a nice juicy lemon the Chinese handed to us. We are still sucking it.

We tried hard to get a few railway concessions in China and spent a lot of money to get in on the ground floor in the old days. If the American Group would take the nation into its confidence and tell it exactly how much it is out-of-pocket in the last twenty years trying to get a little profitable business in China it would probably be not far from a million dollars. Ponder over it. It is over twenty years since the State Department created a monopoly of official support to the American Banking Group, closing the door of equal opportunity to all independent or individual American enterprise in financing China, yet with all this powerful governmental backing, the Group has not been able to put through one profitable deal. The door has stood wide open for this favored combination

with the State Department at all times behind its chosen instrument, but the chosen instrument has not ventured very far away from the portals of safety. A Japanese friend explained to us recently that the "door to Manchuria must remain open." "Otherwise," he added, "how could you get out after you got in." There is more philosophy to that remark than appears at first glance. The "open door" does not merely mean a free entrance, but an unobstructed exit when one wants to get outside again. The American Banking Group assured of every official assistance in getting inside the door has probably reflected deeply on the amount of support that would be extended to it if it got in a jam and wanted to get out quickly with a whole skin. It is very cautious.

### But How to Get Out?

And right here is the real crux of the whole "open door" principle. Americans are not worried about their ability to get inside. Any idiot with money can wander in. Trust the Chinese for that. Americans don't need any guarantee of a free entrance but they are deeply concerned as to whether the State Department will help them to get out.

Many confiding Americans have pranced through the open portals into the Celestial eldorado and staked out a claim, but in nearly every case they came running back yelling loudly for Uncle Sam to help them out. They got out, but they left their shirts behind them. It would be unfair to mention names as most of these adventuresome explorers are great-big-business-men who were glad to get out and save their reputations.

We could however, with propriety, mention the case of our old friend, "Bill" Carey, of the Siems-Carey Company who at one time had a contract to finance and build 2,500 miles of railways in China and another fat job to dig, dredge, widen, straighten out and generally improve the meandering old Grand Canal. His contracts totalled perhaps \$250,000,000 at the outset and he gladly handed over his personal check for \$500,000, to the Chinese as bargain money to clinch the deal. It is a moot question as to whether the State Department was ever whole-heartedly behind him in these negotiations, but the American Minister to China was, and Mr. Carey naturally thought he had a sure thing. Between one thing and another Carey and his friends shelled out about \$2,500,000 before they realized that the contract was a dud. He never built a mile of railway nor did he dredge and improve the sluggish old Grand Canal. But he has a contract and a claim against the Chinese Government for two million and a half, living in hopes that the State Department may one day collect it for him.

The Federal Wireless Company also walked right through the door and grabbed a radio concession when no one was looking that just sizzled with sparks of international trouble. The State Department also got behind this little package of dynamite with full support and stated its determination to see it through. It did just that. The old San Francisco company finally handed over the concession to the Radio Corporation of America who paid for it in good shares and real money. The Radio Corporation is probably out about \$2,500,000 for another dud concession that the Chinese themselves have vitiated by erecting their own plants. However, the Radio Corporation may in a decade or so balance the account by selling equipment to the Chinese Government radio administration, and get its share of the traffic routed to their stations in the United States.

### A Few More Examples

We might also mention the Continental and Commercial Bank of Chicago, which signed a loan agreement with the Chinese Government for a total of \$30,000,000 and advanced the first instalment of \$5,000,000 only to learn that the security allocated to guarantee the interest and repayment of the loan had previously been earmarked for the service of a French loan. This did not shake the confidence of the banker who negotiated the loan. When the first instalment came due for repayment and had to be extended, he declared that the credit of the Chinese Government was so good that its bonds did not require any security. The Pacific Development Company in a moment of generosity handed over another \$5,000,000 of its war profits to the Chinese Government without security as the first instalment on another \$30,000,000 loan. Both of these loans

have been in default for several years, the bond-holders presumably waiting for the State Department to collect the interest for them. Lee, Higginson & Company entered into a loan agreement with the Chinese Government for a similar amount and paid down the first million instalment. This firm was more fortunate than the others, and can thank the American Minister or the State Department for stopping further payments. They got their million back.

We might also mention the American International Corporation that started its career in China by taking over the Siems-Carey contracts and then sent over a commission of mining experts and geologists to search out the most profitable mineral deposits. They went through China with a fine tooth comb and finally recommended the purchase of an old silver mine down in Yunnan near the Burma border. The company went in, took over the mines under a provincial charter, sunk \$2,500,000 in bringing the properties to the producing stage and then—the inevitable happened. The good old Yunnan bandits demanded money and the provincial officials, always hard-up, clamored for their squeeze. Between the depredations of the former and the exactions of the latter, the Americans finally threw up the sponge and withdrew. But they left 2,500,000 good American dollars in that hole in the ground in Yunnan. Ask these high-priced experts what they think of the possibilities of mining development in China or of working such concessions under the "open door" as defined by the Nine Power Treaty!

It occurred to Willard Straight and some of his friends that a big model farm in Northern Manchuria run on American lines with up-to-date agricultural machinery and American management would prove an object lesson to the Chinese and at the same time return a handsome dividend on the investment. Their Chinese comrade leased (in his own name of course) over 20,000 acres of farming land located along the northern reaches of the Sungari River. The company then built houses and barns, imported blooded stock, engaged an American manager, brought in the latest American farming machinery and started to work. The farm was right in the middle of the Hunghutze hunting grounds and they were not long in convincing the foreigners, that the Chinese were not interested in up-to-date methods of farming. They were interested solely in their own time-honored business of holding them up. And they did just that. They finally murdered the manager, swept the place clean of its stock and put the philanthropic enterprise out of business. Willard Straight and his friends sunk about \$300,000 in this venture.

Was the door open? The Siems-Carey contracts, the Chicago, Pacific Development and the Lee, Higginson loans if carried out would have meant an investment of three to four hundred millions of American money in China, without including several other contracts signed by the old American Group that would have brought the total to well over \$500,000,000. Americans cannot say that the door of equal opportunity in China has been closed to them. They enjoyed the same opportunity that the British, French, Japanese and others had, but the other groups knowing that their governments would support them if they went in, took a chance and invested their capital. The Americans knowing that their government would not support them, very wisely for one reason or another, backed out. As a consequence, the British investment in China is over \$1,500,000,000, the Japanese \$1,400,000,000, while Americans piked along for many years with \$160,000,000 (half missionary and half commercial) and wailing because the other fellows got in ahead of them.

Our stake in China is now about \$220,000,000. Four years ago, American capital purchased the Shanghai Power Plant for \$50,000,000 and another group acquired the Shanghai Telephone Company, increasing our stake in the country to its present figure. Both of these enterprises have created a market for American electrical materials of all kinds, the first real development of that nature since the door was opened in 1900. Unless the State Department reverses the trend of its present policy, these companies may also have cause for regret that they ventured into the Celestial eldorado, when the question of the surrender of the Shanghai settlements comes up for final discussion. A few years ago, at the height of the Shanghai troubles of 1927, we had occasion to discuss these matters with a very high State Department official in Washington. After stating the British and Japanese stake in China and comparing them with

our own, (at that time \$160,000,000) I asked, "what would we do if we had a billion dollars invested in China at this time?" The answer came, quick and emphatic; "we would fight to protect it!"

### What Japan is Up Against

This is just what the Japanese are doing in Manchuria to-day. They are fighting not only for their security but to protect an investment of a billion dollars on which their economic life depends. This brings us to Manchuria and a consideration of the "open door" in these regions, to the meat of the principle that Secretary Stimson says we must prepare to go to war to uphold. But before we analyze the "open door" in Manchuria let us meditate over just what the principle means to our general trade with the whole of China. The figures tell us that fifty per cent of our export trade with China is in oil and tobacco, a natural monopoly that no other nation is liable to take away from us in the near future. We can hold that trade without fighting for it. Twenty-five per cent, at the lowest, represents American goods purchased directly in the United States or after their arrival in China, for Japanese industrial enterprises in this country, a trade that comes to us through the operation of the basic economic law that the nation which purchases the bulk of the exports of another country is in the most favored position to supply it with its imports. The United States purchases the bulk of Japan's main export, silk, and therefore is in the most favored position to furnish her import requirements. The Japanese firms handling the silk and cotton trade in New York place with our manufacturers their orders for the requirements of their industrial plants in China as well as in Japan.

This trade therefore stands on its own bottom and cannot be confused with American trade with China. So, here we have a fifty million dollar oil and tobacco business with China and a twenty-five to thirty million dollar trade with Japanese enterprises in China that is not materially affected one way or the other by the operation of the "open door" principle. This trade is handed to us on a silver platter. We have to reach out and make a little effort to collect the profits from the oil and tobacco business, but the money from the Japanese trade is simply pushed into our trousers pocket in New York without our knowing how it got there.

This leaves us with a twenty to twenty-five million dollar trade in sundries that we have to get out and hustle for and pray to God that when we get it we will be paid for it. So an analysis of our trade with China tells us that the open door is concerned with just twenty-five per cent of the total, or say \$25,000,000! This is the stake that Mr. Stimson says we will go to war to defend. We will scrap the disarmament treaty, build battleships, naval bases and fortifications in the Pacific and fight if by any chance Japan closes the door or interferes with our \$25,000,000 trade in sundries with China.

We do not like to be placed in the position of unduly criticizing the State Department. Its officials are a fine group of high-minded men, but they are only human. Each administration places its own interpretation on the policies laid down by its predecessors. It has taken a century to evolve the Monroe Doctrine to its present force in world affairs, yet we have only to go south of the Rio Grande to hear the other side of the story. Americans, listening to the Chinese, may think that Japan is an imperialist nation, but the imperialism of the little Island Empire, fades into insignificance when our Latin brothers begin to expatriate on the wickedness of "Tio Sam." It would jar us out of our self-complacency, if we could sit in and listen to a group of Latin Americans expressing their true opinions about "El Colossus del Norte." Although the Kellogg Pact now ranks with the Monroe Doctrine, there are other fundamentals of government laid down by previous administrations that also become part of the duties and responsibilities of the state that we cannot shirk without losing our self-respect. It would be more to the point, if Secretary Stimson would redeclare his adhesion to the doctrine emphasized during the Coolidge administration and incorporated in the platform of the party which elected Hoover to carry it out. What we would like to hear from Mr. Stimson is an assurance that protection to American lives and properties will be extended and pressure brought to bear to obtain justice for Americans after they get inside the "open door." American traders and business men will always find a way to squeeze through, but if past experience is any criterion for the future, they are going to have a difficult time finding the exit.

# The Door to Manchuria

## Opened and Kept Open by Japan

WE have been a long time getting to the open door in Manchuria, but here we are at last. We might write a book about the past history of Manchuria and explain at length how the southern part of the territory was ceded in perpetuity to Japan in the peace treaty which terminated the war with China in 1895 and how Japan was compelled by Russia, France and Germany to restore the province to China in order to preserve the peace of the Far East. We might go on to describe how China, smarting under the humiliation of her defeat and determined to revenge herself, handed the whole of Manchuria over to Russia under the terms of a secret treaty of alliance aimed at Japan and how when Russia got inside the Celestial door, she promptly banged it to, locked it and threw away the key. Russia grabbed the territory, closed it to foreign trade, travel and residence, created it into a viceroyalty ruled from St. Petersburg and told the rest of the world to mind its own business.

When John Hay invited the other Powers to subscribe to his open door principles he was ignorant of the existence of that secret treaty or he would never have sponsored a doctrine that exposed Japan to aggression while Russia and China were plotting against her. Russia closed the door that John Hay hoped would remain open and then hoisted her flag over the territory. Japan intuitively sensed what it was all about and after entering into an alliance with Great Britain to guard her sea approaches, staked her existence by going to war to drive Russia out of Manchuria and emerged victorious from the conflict.

Ignorant of the existence of the secret treaty of alliance that made the war possible, Japan restored to China her lost sovereignty over the territory she had handed over to Russia and which by all laws of warfare she had fairly forfeited. All that Japan received from her sacrifices was the unexpired portion of a twenty-five year lease to the tip of the Liaotung Peninsula and similar rights to the southern leg of the Chinese Eastern Railway, known as the South Manchurian line. In ratifying the treaty with China, Japan also obtained one other advantage that may as well be mentioned here in order to clarify a most important angle to the whole Manchurian dispute. In the treaty and additional agreement relating to Manchuria signed between China and Japan on December 22, 1905, appears the following initialled clause, which the Chinese declare is a forgery :

"The Chinese Government engage, for the purpose of protecting the interest of the South Manchuria Railway, not to construct, prior to the recovery by them of the said railway, any main line in the neighborhood of and parallel to that railway, or any branch line which might be prejudicial to the interest of the above-mentioned railway."

In the supplementary agreement for the construction of the Canton-Hankow Railway of July 13, 1900, (antedating the Japanese agreement five years) between the American-China Development Company and the Chinese Government, appeared the following in Article 17 :

"It is further agreed that without the express consent in writing of the Director-General and the American Company, no other rival railway detrimental to the business of the same is to be permitted, and no parallel roads to the Canton-Hankow Line are to be allowed to the injury of the latter's interest within the area served by the Canton-Hankow main or branch lines."

The same clause with slight variations in wording is found in the Shanghai-Nanking Railway Loan Agreement signed between the Chinese Government and the British and Chinese Corporation on July 9, 1903, or two years before the Japanese agreement. The Chinese have advanced the argument that the Japanese forced them to sign the 1905 agreement against their wishes as they were anxious to preserve the principle of the open door in Manchuria. Yet the

precedent prohibiting the construction of competing and parallel lines was created by an American Company and the right was conceded without protest. The same is true of the similar rights conceded to the British. Japan asked for and received no more than had been voluntarily conceded to the United States and Great Britain. What was a purely legitimate commercial precaution where America and Britain was concerned became a violation of the "open door" and infringement of China's sovereign rights when conceded to Japan !

### Japan's Inheritance

Let us return to our story. During the Russo-Japanese war as the Russians retreated northwards they destroyed the railway tracks, blew up the bridges, withdrew the rolling stock and left nothing but a road bed for the advancing Japanese to march over. The Japanese were somewhat out of luck as their own rolling stock was all narrow-gauge material, wholly unsuited for the heavy demands of an army on the battle field. But they went ahead, repaired the line, altered the gauge, brought over from Japan their own little rolling stock and managed very efficiently to maintain their communications. When the war ended and the peace was signed they fell heir to just what they had improvised on the ground. All they received was a broken down right-of-way, no rolling stock, no bridges and no equipment. For several months, or a year after the war, the temporary narrow-gauge line was employed almost exclusively for military purposes and whenever there was any space on the cars not taken up by the army, it was allotted to freight of Japanese merchants seeking a market for their products in the hinterland.

Let us get this picture straight, even at the cost of repetition, as it has an important bearing on the whole "open door" controversy in Manchuria. In 1895, China handed over Manchuria to Russia under the provisions of a secret treaty of alliance aimed at Japan in order that Russia could get into a favorable position to accomplish a job that China herself was too weak to perform. Russia then callously betrayed her Ally, annexed the territory and closed the door to trade. The United States declined to go to war with Russia to enforce its own doctrine. Japan did go to war with Russia, primarily to defend her own existence, but incidentally she opened the door that Russia had closed and restored to China her lost sovereignty over the territory. This war cost Japan about a billion gold dollars and two hundred thousand lives and all she got out of it was busted, broken-down narrow gauge railway equipped with her own rolling stock, or, a right of way with the road-bed and embankments in fairly good condition. As soon as the war was over, the merchants of all nations, naturally anxious to pick up the loose ends of their business, began to protest when they found that the little military railway was hauling exclusively Japanese goods. The loudest howl of all came from Americans.

### Post War Conditions

Before the war, American textile manufacturers had developed a good trade in Manchuria in a line of heavy grey cotton goods that met the peculiar needs of the market. We never made any special exertion to create or develop this demand. It was just one of these wind-falls that came to us through the activities of a few American firms in Shanghai dealing largely in piece goods. When the Japanese get their toe hold in Manchuria they went right after that textile business the first thing. The Manchurian farmers and shop-keepers had little money, but they had lots of beans and cereals that Japan needed. So Japan traded her textiles for beans and bean-cake and established a market by barter while the other fellows were ice-bound in Newchwang and couldn't move their goods except by cart. The Americans and British frothed at the mouth, sent

deputations from Chambers of Commerce and parties of business men to investigate and report on conditions, flooding Washington and Downing Street with protests against Japan's unfair use of the railway.

Japan soon found that by opening the door in Manchuria she had stirred up more trouble than the war itself. Nothing she could do or say would satisfy the clamor of those who wanted to capitalize immediately on her sacrifices. She was up against an entirely new proposition that harbored the germs of another war. The real difficulty lay in the inadequate transportation facilities of the narrow-gauge line clogged with evacuating an army and military stores and meeting the demands of her own traders.

Japan took the bull by the horns and started in to completely rebuild the railway to standard gauge and equip it with new rolling stock. In organizing the South Manchuria Railway Company, the Japanese Government invited the Chinese to subscribe to its shares and become joint owners in the new enterprise. The Chinese, still smarting under the defeat of their Russian ally and humiliated a second time by the success of Japan's armies, indignantly rejected the overture to become shareholders in the new railway. So the Japanese provided the initial capital themselves and then went to their British Allies, presented their case and asked for a loan of £20,000,000. They get it. Playing the game fairly, the Japanese then invited British manufacturers to bid on their requirements. Just at that moment British railway material manufacturers were working day and night to fill their outstanding orders and their quotations were not only too high but they could not guarantee delivery in less than eight months to a year. Here was Japan with a hornet's nest of angry American piece-goods men buzzing around her demanding the right of equal opportunity to get their goods into the Manchurian market; with Washington shaking its finger and reminding her of her obligations under the Hay Doctrine and an equally persistent Ally who had advanced the funds to rebuild the railway and confidently expected to book the orders for equipment, but could not guarantee delivery in time to appease the trade-hungry Americans.

What did Japan do? She went to the United States and fortunately for us, brought her problem to the one man in the country who had the vision to understand that here was the chance of a lifetime. The Japanese came to our old friend "Jim" Farrell, who only a short time before had been permitted by the United States Steel Corporation to organize an export sales department and grudgingly allocated him five per cent of its total output for marketing abroad. As we recall, after the first year, Mr. Farrell was booking orders up to fifteen per cent of the tonnage made by the corporation and yelling for more. When the Japanese came to him with the South Manchuria proposition, Mr. Farrell saw the opportunity to do something big for American engineering trade in Asia that would put us on the map and keep us there. He got his friends together and between them, they bagged the complete order for rails, bridges, locomotives, cars and all other major requirements by quoting a reasonable price and guaranteeing immediate delivery.

### American Initiative on Trial

The British were flabbergasted and somewhat peeved at losing this business. At that time, Britain had almost a monopoly of available ocean-going tonnage and it occurred to them that they could still come out ahead by boosting the freight rate on these big shipments. They tried it and stuck to it, but "Jim" Farrell wasn't going to lose all that he and his group stood to make out of the deal, so he answered the challenge by chartering his own line of steamers and saved the day. Steamer after steamer began to arrive at Dairen and discharge American locomotives, passenger and freight cars, rails, bridge material and even the most up-to-date Pullman coaches. The Japanese did not do things by halves. They bought the best that America could supply. They set out to construct a railway to complete American standards and specifications and succeeded. The Japanese did for us in China what we have never been able to do for ourselves and to-day the South Manchuria Railway stands as the most wonderful advertisement of American railway practice and efficiency in operation that exists outside the United States.

We do not know all that the original order covered, but we do know that up to 1920, the South Manchuria Railway had purchased materials in the United States to the value of over \$50,000,000. In addition, its allied and subsidiary enterprises together with private Japanese industrial establishments purchased another \$25,000,000 in equipment bringing the total up to \$75,000,000. The total to-day is in the neighborhood of \$100,000,000.

All the time we were furnishing this material to the South Manchuria Railway, American traders in textiles and muck and truck lines, were howling about the "open door" while our consular officials and newspaper writers were busy creating the bogey that the Japanese were out to get all the business there was in Manchuria. It was difficult at that time to find a man in our government services that would admit that Japan was playing the game, even when the facts were brought to their attention. The British, the French, the Belgians and the Germans had advanced loans up to \$150,000,000 gold, to build and equip the railways in China Proper in order to supply the materials and equipment for these lines. About fifty per cent of these loans were spent for materials in the countries furnishing the funds, so our European friends, after lending China \$150,000,000 received in orders for materials about \$75,000,000. Mind you, on those foreign loan-built lines, American material was religiously excluded. We didn't get a smell of the business. Yet while we were loudly ballyhooing about the "open door" and the State Department and the American Group were laying awake nights trying to think out some way so pry a railway concession out of the Peking Government that would provide a market for our railway supply manufacturers, the Japanese handed to us on a silver platter and without lending them a cent, orders for railway materials that equalled all the orders that went to Europe to equip all the rest of China's loan-built lines! The Japanese paid cash for their materials. We didn't lose a cent. We got the same business from the South Manchuria Railway for nothing as though we had financed all the other railways in China. The Japanese borrowed the money from the British which by all rules of the game should have gone to British manufacturers for railway materials and spent it in the United States in order to stop our hullabaloo about the door they had staked their existence as a nation to open for us, and in doing so, gave orders that equalled, if not exceeded in value all that the European Powers had obtained as a result of their sphere of influence diplomacy. We make the categoric statement and challenge its refutation, that in dollars and cents we benefited more by Japan's opening the door for us in Manchuria than all the other Powers combined extracted from their sphere-of-influence railway contracts and concessions in China Proper. We didn't get even a look-in on that business. We were not entitled to it and we were not entitled to any of the South Manchuria Railway business. But we got it at the expense of the British and we are still pulling about the closed door in Manchuria. When we recall the diplomatic squabbles, negotiations, bargainings and combinations that characterized our efforts to get in on the ground floor in China and the invoking of treaties, declaration of principles and what-not in order to butt-in on the business the other fellows created and realize that to-day we have not built and equipped a mile of railway in China and that most of the material sold to these Chinese Government lines is still unpaid for, we can begin to appreciate what the Japanese did for us in Manchuria.

Were we thankful for this business? Mr. Farrell and his associates were, but you could never get a word of recognition or approval from our officials. When these facts were brought to their attention they retorted that they were not interested in railway material. What they wanted was the open door for trade, the bread and butter business that counts in the long run. Perhaps they are right.

### What Manchuria Has to Offer

So let us look at Manchuria as a trade outlet for the general line of American goods. Here again we hardly dare stress an interest in maintaining the open door to purchase Manchurian products without inviting a howl from our farmers. Run over the list; soya beans, other beans, maize (the Senator from Iowa will be interested in this item) kaoliang, millet, sesame seed, hemp seed, bean cake, bean oil, other oils and fats, bristles, wool, hairs

and feathers, sausage casings (the Mongolian kind enables us to slice the boloney a little finer) coal and coke (imagine) and even a little iron, all of which in 1930 reached the tremendous total of 54,725 tons valued at Taels 5,238,000 or \$2,410,000. (In 1930, the Haikwan Tael was down to .46 cents gold.) In addition, there are a few million dollars worth of furs that go out by parcel post and which do not appear on the trade returns.

In the same year, Japan purchased 3,129,500 tons of Manchurian produce valued at Taels 114,000,000 or \$52,440,000, or about twenty-five times more than we did. How about our exports to Manchuria? That is what we are really interested in. Well, during the year 1930, the United States sold 142,000 tons of goods to Manchuria valued at Taels 20,600,000 or \$9,476,000, showing a balance in our favor of seven million dollars. Rather good for a closed door. During the same year, Japan sold to Manchuria 488,000 tons of goods valued at Taels 110,000,000 or \$50,600,000, or five times more than we did. Japan's trade is therefore evenly balanced, a very equitable and sound arrangement. (In 1929, American trade with Manchuria was Taels 10,204,000 [\$6,500,000] imports and Taels 26,000,000 [\$16,640,000] exports, the exchange value of the tael for that year being .64 cents gold.)

America's range of exports to Manchuria cover nearly all the main items on the list, but it will surprise us to learn that about one-third of our 1930 and over a quarter of our 1929 trade was in wheat and flour. Just like sending coals to Newcastle. When law and order is restored in Manchuria and the farmers can again grow the wheat to keep the flour mills in Harbin operating full time, we must expect to lose this little windfall which reduces our legitimate trade to about six million dollars.

We can hold the bulk of the rest of our trade in oils, tobacco, raw cotton, hardware, machinery, vehicles, etc, and what we may lose in some items will be made up in others. To simplify the argument, let us stick to the 1930 figures which reveals that we can sell to Manchuria legitimately about \$6,000,000 worth of our products in exchange for about \$2,000,000 of Manchurian produce, while Japan sells over \$50,000,000 worth of her goods in exchange for a like amount of Manchurian produce. Japan's business follows the economic law that a nation which consumes the bulk of the exports of another country is in the most favored position to supply it with its imports, a natural advantage that no other nation can take away from her. Before the United States begins to worry about the open door in Manchuria we ought in all fairness try to balance the trade that now stands so largely in our favor. If we want to sell more, we should buy more, but we hazard the prediction that if we ever do buy more Manchurian produce and our farmers find it out, somebody in Washington will hear about it.

### One Essential Factor

There is just one basic condition to the improvement of our trade with Manchuria. There is no use in invoking or talking about the open door until the purchasing power of the people is restored through a return to sound currency and their right to dispose of their crops in the open market. We cannot sell to a people loaded down with billions of worthless paper notes that cannot be exchanged for even the bare necessities of life. We can sell to the robber barons who have forced this worthless paper on the farmer in exchange for his crops and then selling them for the gold that enabled them to maintain their armies to perpetuate their graft. We have done a nice sticky business with these bandit overlords and rather pride ourselves on getting it. They built arsenals, bought arms, munitions, aeroplanes and the usual military truck that goes with it. Chang Hsueh-liang had the biggest arsenal in the world and was always in the market for machinery and machine tools of sorts. He also operated a few electric plants, erected to keep the Japanese power lines out of the Chinese cities. Some of the orders for this arsenal and electrical light plants went to American firms, not because they were cheaper or preferred, but simply to bring Americans into Manchuria to offset the Japanese influence.

The Chinese also built some railways and we got a fair share of the rail, bridge and car orders. I think we got paid for it too. The Japanese also built some railways for the Chinese even advancing the money, but they didn't get paid for their work. They have never received even the interest on their loans. The Chinese

took over the lines the Japanese built for them and used the money that should have gone to Japan to build other lines to compete with the Japanese lines and placed their orders for materials in Europe and America. China robbed Japan, but paid Americans and Europeans with the money. Of course, it may not have been with the same money, but it all came out of the same loot whether taken from the people or stolen from Japan.

We don't know just how much engineering material we sold to the Chinese authorities in Manchuria in 1930, but we know how much came into the province for all purposes. Including automobiles, it was a little over Taels 5,000,000 or \$2,300,000 gold. The Japanese sold during the same year over Taels 26,000,000 (\$12,000,000) worth of machinery, iron, steel and engineering supplies to Manchuria. It is fair to assume that most of the Japanese imports of machinery went to the South Manchuria Railway and other Japanese enterprises and it is also certain that a fair percentage of the American imports of machinery were destined for Japanese enterprises, probably one half. This gives us a fair idea of the value of the Manchurian machinery market, say \$13,000,000 for Japanese and \$1,500,000 for Chinese consumption. It is impossible to get the exact figures to make a correct analysis of this trade, but the above is not far from being correct. The machinery market in Manchuria outside of the Mukden arsenal and three electric light plants is essentially Japanese.

Our oil and tobacco sales to Manchuria for 1930 was about \$3,000,000 which, with our \$2,300,000 sales of machinery, automobiles, steel, etc., represents our major interest in the market. After eliminating the wheat and flour windfall for the year, there is a little more than a million dollars left for sundries. Suppose our fears are justified and the door to equal opportunity should be closed in Manchuria it would affect principally those items not included in our oil and tobacco monopoly or a total of \$3,000,000. Suppose, further, that Japan cuts into this and takes away all the automotive and vehicle trade (\$500,000), the electrical trade (\$100,000), machinery (\$900,000), railway materials (\$50,000), and our steel (\$350,000) say \$2,000,000 in all, who will be hurt? (*It may be fairly said that in taking the 1930 trade returns with the Tael at .46 cents as a representative year, we have understated the value of the market. This however was not intention. Those who may want to quibble over the exchange rate can add fifty per cent to the 1930 figures, but it does not materially change the general picture.*)

It is possible that we will lose all the electrical business in Manchuria. Japan will get it all, or nearly all. The plans are now being drawn up for a great super-power system or hook-up that will embrace all the cities in Manchuria from Port Arthur to Harbin and Mukden to Antung, including Kirin, with the big central power station located at the Fushun Mines using dust and other unmarketable coals for fuel. The Chinese Government or semi-official plants at Antung, Mukden, Kirin and Harbin will be merged into this system and the American engineering firms who have supplied materials to these undertakings will lose the business. As far as they are concerned the door will be closed. Now the bulk of this American electrical machinery business with the Chinese in Manchuria has been placed with an American firm in which the General Electric Company holds the controlling interest. The General Electric Company also holds about forty per cent of the capital stock of the Shibaura Engineering Works in Japan, the largest manufacturers of electrical machinery and equipment in that country. These works are the last word in mechanical efficiency, recently rebuilt and equipped with the most up-to-date American machinery. If the General Electric Company's engineering firm in China loses this Manchurian business to Japan, it simply takes its profits from that end. Its subsidiary in China may lose a little business, but it will more than make up for it by the surer profits from its Japanese partners.

The Westinghouse interests have a similar working arrangement with the Mitsubishi organization in Japan. The Western Electric Company (a subsidiary of the International Telephone and Telegraph Company) has a fifty-fifty interest in the Nippon Electric Company, the largest makers of telephone and telegraph apparatus in Japan. The General Electric Company has a fifty-fifty interest in the Tokyo Electric Company, the largest makers of electric lamps and accessories in Japan. The Sumitomo interests in Osaka, makers of electric wire and cables, instruments and other

electrical specialities have a very close working arrangement with several American manufacturers of similar goods. There are other minor connections between Japanese manufacturers of electrical machinery and Americans, but the above are the most important and these most likely to get the business in Manchuria.

Here again, we are confronted with the dilemma of how we want to take our profits, whether with our right hand or with our left. If we take it with our left hand through our Japanese partners, we do not even have to make the effort to hold the hand out. It will be paid into our account. If, however, we insist upon having it the other way, the right hand will always be outstretched, reaching for the money that is mighty hard to pry loose from our Chinese official customers and there are always a lot of itching palms that want a little squeeze out of it.

### Americans Lose Nothing

Under the guidance of Japan the new state of Manchuria will become an important market for all kinds of electrical machinery and supplies but the Japanese manufacturers will practically monopolize the business. British, French and German manufacturers may lose a little business, but the Americans lose nothing. In fact, they will gain through the increased volume of business done by their Japanese partners. So it is hardly likely that the United States will go to war over the door being closed to our manufacturers of electrical machinery and supplies.

The development of Manchuria will include the building of a new highway system, and although no definite plans have as yet been drawn up, the territory could easily do with 10,000 miles in the next ten years, calling for as many automobiles and trucks. This is a very low estimate and depends entirely upon the prosperity of the new state. The value of these automobiles may be put at \$7,000,000 or \$700,000 a year. Only the very high priced models and the heavier trucks will be purchased in the United States or Europe while the rest of the business will undoubtedly go to the General Motors and Ford factories in Japan. This business will appear in the Manchurian trade returns as imports from Japan, while the trade returns of Japan will show a corresponding increase in the importation of automobile parts from the United States. Here again, we must make up our mind whether we want the money paid into our right hand or into our left. There may be some complaint from American workmen over this system of increasing the national wealth, but the damage, if any, has been done. Japan is only one of several countries where we have erected branch factories to take care of the needs of the markets. These American factories, importing the chassis and mechanical parts from the United States, using wherever possible local products to complete the car, are operating under special advantages and enjoy preferred transportation facilities in shipping their products to the Manchurian market. It will be difficult to compete with them. After all, it is our business and every new car or truck sold increases by that much the market for our gasoline and lubricating oils, a quasi-American monopoly.

Americans may also expect to receive the bulk of the orders for such road making machinery as may be needed for the new highway system. Ordinary dirt roads will continue to be thrown up by native labor but the main arteries of traffic will call for heavier construction and surfacing. The existing cities and towns and their extensions, together with the proposed new capital city will also create a demand for road making machinery, culverts and other accessories.

The main development of Manchuria however must be along agricultural lines. Here lies an empire in the making. But no advance can be made without the establishment of law and order, protection against bandits and freedom from confiscation of the crops by rapacious officials. Manchuria even now is a vast granary, but the land is worked by slaves whose produce has been seized by their bandit overlords in exchange for worthless pieces of printed paper. Before Manchuria can become a market for anything other than the bare necessities of life, the purchasing power of the people must be restored by the abolition of confiscatory taxation and the retirement of billions of dollars of worthless paper currency. Such business as came to American firms under the old régime was purely governmental, paid for by the coin wrung

from the toil of the farmers. The "open door" in Manchuria under the rule of the Chang dynasty was merely the right to do business with a bandit oligarchy. They built arsenals, some railways, electric light and other plants in order to freeze out the Japanese and placed a fair share of the orders for materials with American firms to gain our good-will and diplomatic support. That is all there is to the open door, a precarious business with the Mukden, Kirin and Heilungkiang satraps, made possible by their illegal purchasing monopoly of all crops and their cornering of all wealth by the issuance of unlimited amounts of inconvertible paper currency. Outside of oil and tobacco there was no real business with the people of Manchuria for the American trader. And there will be no real business, no great expansion of trade, until the wealth of the country concentrated in the hands of the bandit oligarchy is again distributed to the people.

### What the Future Offers

When the farmer is permitted to sell his crops in the open market and receive real money in exchange, the first step will be made towards restoring the purchasing power of the people and laying the foundation of a real and lasting prosperity that will open up a market for American and other products that has hitherto been closed. We may lose the picayune business that the Changs and their lieutenants handed out to our firms in Mukden after extracting the last possible cent of squeeze and making us wait years for our money, but we will open up a new, cleaner, more respectable and more profitable market with the thirty-odd million consumers of Manchuria that will more than compensate us for the loss of the tainted business from their bandit overlords. We can do business with the people of Manchuria and preserve our self-respect, something we have never been able to do with their rulers.

There is no limit to the possibilities for agricultural development in Manchuria and Mongolia and the market that such expansion will create for agricultural machinery. Up to the present, it has been almost impossible to sell farming machinery in Manchuria, except in isolated instances to the official landlords and slave owners. When we use the word *slave owners*, we mean just that, as the system is the same as peonage in Mexico or the old serfdom of the Russians, only worse. Twenty-nine years ago, when this magazine was started in Manila, one of our first advertisers was the Kelly-Springfield Road Roller Company whose office in Manila carried a line of agricultural machinery. As a result of this publicity, their Manila agent received an inquiry from the Governor of Heilungkiang Province in China for some modern farming machinery. He hurried north and came back with a magnificent order which included some steam plowing outfits, binders, reapers and other implements. At the time it looked as though a new market for our agricultural machinery was to be opened and our old friend grew enthusiastic over the brilliant prospect opened up for his firm. We followed that initial sale with great interest and for years afterward every time we visited Manchuria we asked about it. After the delivery and first experimental trials of the machinery, the Chinese Governor lost all interest in his new toys and there they remain, rusting away somewhere out beyond Tsitsihar, a monument to Chinese progress.

During the last two decades, several other consignments of modern farming machinery have been sold to Chinese official landlords in Manchuria and with more or less similar results. It was cheaper to lure the poverty-stricken immigrants from Shantung to work for them on shares and then take away their portion of the crops by paying the poor devil in paper notes that were worth nothing at the time and little less than nothing when the farmer tried to exchange them for commodities. Agricultural machinery could not compete with this official Chinese get-rich-quick system, so the market has been practically closed.

There has been a fair demand for smaller farming implements which our manufacturers have done their best to develop. The International Harvester Company maintains an extensive show room in Harbin exhibiting samples of all its products suitable for the market and is everlastingly on the job. Other American manufacturers are represented and keenly interested in the possibilities. The Germans are also seeking their share of the business, while during the past year, occasional machines built to American

specifications slip in through Soviet Russia, the product of their new factories. From almost nothing, this business grew until in 1929, \$640,000 worth of agricultural machinery was imported into Manchuria through Dairen, but the bottom fell out of the little boom by reason of an unprecedented issue of paper currency and there has been no revival since. In anticipation of an increasing demand, several firms imported large stocks of plows and other implements, but the sudden drop in the purchasing power of the people has made it impossible to dispose of them.

Yet this is the one market that offers the greatest inducement to American manufacturers as a permanent outlet for their specialties, a market that we can reasonably hope to supply up to at least eighty per cent of its requirements. It is fair to estimate that under any system of government that recognizes the right of the people to sell their produce in the open market and which guarantees protection against the bandits, the demand for American agricultural machinery in Manchuria will jump the first year to a million dollars, with the certainty that within five years, it will be five million and perhaps more. There is no reason why Manchuria alone should not provide a market for at least thirty to forty million dollars in agricultural machinery and whatever the total may be, at least eighty per cent will be supplied by America. The door to this business is now closed by a group of bandit overlords and not until the people of Manchuria are freed from this system of misgovernment can the door to real business be opened to us.

### Future Possibilities

This analysis of our trade possibilities in Manchuria under the open door is only one side of the picture. While Americans are interested solely in what they can sell, the Japanese are more concerned about what they can buy. If Japan has anything to say in the development of the new state and her people are conceded the right to own and lease land, they can be depended upon to go into large-scale farming along the most approved and up-to-date American lines. We are often told that the Japanese cannot live in Manchuria and compete with the Chinese. That may be true, but it is also true that they have never had the chance to try it out, for the simple reason that although they were conceded the right to lease land in Manchuria and Mongolia under the 1915 Treaty, the Chinese Government has never permitted this clause to become effective. Once this restriction is removed and the Japanese can own and work their own lands in Manchuria and Mongolia, it will not be long before vast tracts are brought under cultivation. Within the next few years, Manchuria may once more become a great wheat producing center, like it was before the soya bean ready-money craze made it almost a one crop country. Our farmers will then lose their profitable Japanese market. But, on the other hand, we are furnishing Soviet Russia with the machinery and the equipment for plants to make their own agricultural machinery that in due course will enable her to become a formidable factor in the world's wheat trade. Japan also wants her own food supply and is determined to get it in Manchuria.

Japan's interest in Manchuria as a source of food is not confined solely to agricultural produce. She is also interested in meat. Japan has no grazing grounds on which to herd cattle and sheep, so her main diet comes from the seas. The Sea of Japan and the surrounding waters of the Pacific are Japan's grazing grounds, just as essential to the life of her people as the prairies of the West are to the United States. Deprive Japan of certain fishing rights and her people starve. The Soviet and Japan are always at loggerheads over the fishing grounds in the Otskotsk Sea and some day Japan may lose her rights to these near-by sources of food supply. Japan is therefore looking a long ways into the future and foresees the day coming when the seas may not supply her mounting millions with their staple food. She may have to turn to meat and the only near-by region suitable for cattle raising on a large scale is in Manchuria and Mongolia. Here again, only by enjoying the right to own large tracts of land in these regions, can Japan hope to create a new meat supply and, once more the success of a cattle industry in Manchuria and Mongolia depends entirely upon the suppression of banditry and the maintenance of law and order. Japan therefore has no option but to assert her rights under the treaties and if needs be, fight for her right to exist. The Japanese may become fed-up with fish and crave a nice, big, juicy beef-steak or a mutton chop

for a change. Try and find one in Japan outside the big tourist hotels. You are lucky if you get a chicken. Now the Japanese may like fish. Maybe that is what is the matter with them. If we could get them eating meat, they might become more like us and we would understand each other better. Even the pacifists of America would grow bellicose and break through the Kellogg Pact, and all other treaties for their right to continue to eat a nice roast of beef, veal or mutton. Feed them on raw fish, codfish balls, eels, lobster, crabs and seaweed salads for a year or so; tell them they cannot have meat except as a high priced imported delicacy from Mexico and I'll guarantee that in sheer "self-defense" the American army will cross the Rio Grande and never stop till it reaches the Panama Canal. If Japan is given a fair chance in Manchuria she will develop the farms that will use our agricultural machinery in large and increasing quantities. Japan will start a cattle industry that will call for refrigerating plants, cold storage steamships and all the other appurtenances of the meat industry. America will receive its full share of that business. The Japanese do not make farming or refrigerating machinery.

### And About Mining

New let us look at the mining possibilities. The other day one of our American commerce officials discussing trade opportunities in Manchuria became somewhat worked up over the possibility that American capital might be frozen out of the development of mines in these regions, that Japan would hog it all. He cited the case of a British company which a year or so ago acquired a gold mining concession that certainly would be cancelled by the new state and handed over to the Japanese. In fact, he was more worried over this British concession than anything else, as in his opinion it pointed the moral to what Americans might expect.

The story of that British gold mining concession is no different from many other similar transactions in China. It was true to type. A British mining promoter who had some money of his own came out to Manchuria looked over the ground and saw that it had possibilities. He wangled a prospecting license out of the Big Chief at Mukden and after considerable preliminary work he interested a group in London to finance a dredging company. The head of the group (an old experienced China-hand and mining specialist) came out to China to settle the deal with his old crony Chang Tso-lin. Chang was delighted with the visit and said in effect: "My dear old friend, you want gold? I will do anything for a friend, and you can have all the gold you can find in Manchuria, but before we sign the agreement, how about a little loan of £3,000,000? I am short of ready cash just now and will pay you back out of my share of the gold you dredge up out of Manchuria?" Chang was talking real business. He knew better than anyone else just how much gold his dear, old friend, might extract from the bottom of the northern Manchurian rivers and was taking no chances about his share of the profits. He wanted his at once. The old China-hand, who knew the game backward and forward, and knew that it was just like kissing good-by to his money, side-stepped the proposition and courteously made his departure. The deal fell through.

There may be gold in Northern Manchuria, lots of it, but "gold is where you find it." Any outcrop that has not been worked out or any alluvial gold that has not been panned out by the Chinese during the past twenty or more centuries would be hard to find. My friend, Solomon Skidelsky and his father engaged a group of the best Russian mining experts over twenty years ago to prospect and investigate the gold mining possibilities of the Amur and Three Rivers Districts. They spent over \$200,000 in two or three years and gave it up as a bad job. Skidelsky has a mountain of fine geological reports stored away in his office, but no gold. Americans are welcome to any gold that Skidelsky overlooked, but they will have to dig or dredge for it. Gold is there, down at bed-rock somewhere, but it will require a lot of drilling and proving the ground before capital will be forthcoming to finance the expensive dredging outfits required for this type of mining. That door is wide open to us, if we want to take a chance on a fifty-fifty proposition with the Chinese authorities. But in our humble opinion, Americans can well afford to let the Japanese tackle the prospecting end of the job and sell them the dredges and other machinery. We will probably profit more from this end of the business than by risking our capital

in the workings. We may get in, but would we be able to get out. If the Japanese go in, their Government will see to it that they stay in. Here, again, the success of any gold-mining scheme in northern Heilungkiang depends upon the maintenance of law and a stable and responsible government to deal with. Otherwise, between the Hunghutze and the local officials they will get all the gold the foreigner may dredge out of the ground and the foreigner will get the experience and fun of putting up the money. Chang Hsueh-liang may be the head of the Manchurian government, but his rule does not run in Heilungkiang. A foreigner may sign a hard and fast agreement contract with Marshal Chang at Mukden and the Governor at Tsitsihar may even condescend to countersign it, but it carries no weight with the local district authorities on the far off banks of the Amur. If by any chance, this subordinate was duly propitiated, then the commander of the local military would have to be greased, failing which, the Hunghutze would take it all and divide with him. The possibilities for gold mining in Manchuria may be alluring, but if Americans are to take a chance our advice would be to wait until the new state is firmly on its feet and then play in with the Japanese. Otherwise, it would simply be another case of the open entrance and a closed exit.

### Another Bubble that Broke

In this connection, we recall another little group of old friends who had a very rich gold mining concession in Mongolia. "Eddie" Mills and John Francis Manning, two perfectly good Americans, Harvard graduates and all that, socially popular, energetic, on the job and all-round good fellows who deserved success. Mongolia is also an integral part of China, recognized as such by the Nine Power Treaty, the Open Door Doctrine, the League of Nations and a wad of other perfectly good paper affidavits to the same effect. Even Soviet Russia recognized the sovereignty of China in Mongolia —on paper. Mills and Manning had their headquarters in Peking and were strong for the "open door," feeling assured that the Legation and the State Department would back them up. So they breezed into Mongolia and in some way acquired the concession to work the celebrated Mongolor Gold Mines. They formed a company, sold some stock and went hopefully to work. Then along came the Soviet and told them to "get out." They went. Did the State Department threaten to go to war with our dearly beloved friends in Moscow over this violation of the treaties? Maybe it did. It probably protested in order to keep the record straight, but that didn't help Mills and Manning to get their money back. The door was open for these two good Americans and like all the others who staked out a claim in the Celestial eldorado, they went broke. They are now working for a living. Manning is having a perfectly wonderful time superintending the building of some bridge piers in the fragrant ozone and muck of the Pearl River at Canton.

Let us return to Manchuria. There are other mining possibilities but they are largely confined to coal. To date, only six coal mining propositions have been developed, the Fushun and Yentai properties in South Manchuria that belong to the South Manchuria Railway Company and the Penshihu Mines, a joint Sino-Japanese undertaking. These are all good properties but it is becoming increasingly difficult to market their output. Then there is the Chalainor coal mine located near Manchuli and owned by the Chinese Eastern Railway. At one time when under lease to Skidelsky & Company, these mines turned out about 3,000 tons per day. When the Soviet troops invaded China in 1929, they bombed and flooded their own mine and it is now a wreck. For the present it is out of the picture. Anyhow, it belongs to the Soviet and its output can be sold only to the Chinese Eastern Railway. It is not likely to figure in any development scheme by foreign capital.

There is also the Muling Coal Mines, located on the eastern division of the Chinese Eastern Railway and connected with it by a branch line owned and operated by the mining company. These mines are the joint property of the Kirin Government and Skidelsky & Company and are now turning out about 1,500 tons per day. Their principal market is the Chinese Eastern Railway which may or may not purchase its output according to the whims of the Soviet directorate of the railway. Just now the Soviet is purchasing its coal for the railway from its own mines at Suchun, near Vladivostok and the adjacent workings confiscated from Skidelsky. The Muling Mines are therefore having a hard time of it to find a market for

their output. Theoretically, the Chinese are also joint partners in the management of the Chinese Eastern Railway and they would like to sell the output of the mine they are also partners in to the railway. But the Soviet turns a deaf ear and patronizes its own mines at Suchun. As the Muling coal is of excellent coking quality, it may in due time, find a good market in Japan. But this depends on the construction of the Kirin-Kwanei Railway link and a 150 mile connection with the Muling line, in order to provide the necessary deep-water outlet in Korea. This is one of the most promising mining possibilities in Northern Manchuria, but its success depends either on its ability to furnish the Chinese Eastern Railway with coal or an outlet that will enable its output to be exported to Japan. As the Kirin Government is half owner in the property the probability is that if the mine and the whole coal bearing field of which it forms a part, is over developed to its full capacity, the capital will be Japanese who need the coal for coking purposes. However, there is nothing to prevent American capital from acquiring the Skidelsky interest, if he wants to sell. That door is open.

There is still another Chinese open cut coal mine located up the Sungari River producing about 100,000 tons of fine steaming and coking coal a year, relying for its market on the Sungari River steamers and the city of Harbin. This is said to be the best coal in Manchuria, but it needs an expensive washing plant to prepare the output for the market. This completes the mining possibilities of Manchuria. There may be other good coal mining proposition awaiting exploitation, but until the country is developed and a market created for the output, they also must remain outside the picture. After all, the same rule applies here as with gold-mining and dredging. The Japanese do not manufacture high grade mining machinery and Americans will probably profit more by letting them supply the capital to work the mines and sell them the equipment. It is safer and surer in the long run.

### The Railway Situation

What is left for us to worry about in Manchuria? Railway construction and supply of railway materials? We can hardly expect our share of this business unless we advance the funds for construction. Our railway rolling stock and steel manufacturers find it difficult enough at the present time to compete with the Europeans in the open market for Chinese official business, except in such instances where the Chinese are anxious to get us in for political reasons. The last trade returns indicate that the Belgian-Luxembourg Steel combination is the foremost factor in the China market to-day. Americans have done some business in Manchuria but these orders came to us at the expense of Japan, who built and equipped other lines for the Chinese and were never paid, releasing the funds that the Chinese then used to build competing lines with the South Manchuria system and purchase their equipment from Europe and America. As far as we were concerned it was a legitimate business, but certainly not a healthy one. We havn't sold a locomotive in Manchuria since God knows when. This market is practically closed to us now, even on the Japanese lines, whose requirements are supplied by their own railway shops in Dairen or from the big railway material makers in Japan. The Japanese Government Steel Works at Yawata are now able to roll the heaviest rails and structural steel shapes and in the past few years have filled many orders for the Japanese lines in Manchuria. We are not much better off in China Proper as far as railway materials is concerned, for the only money that the recognized government can lay its hands on, is the remitted British Boxer Indemnity (about £11,000,000) which must be spent in England for the purchase of materials. Until there is a stable government in China there will be very little profitable railway business for us there. Our only hope to get in on the ground floor is to furnish the loans and the time when this will be possible is becoming more and more distant. The new state Manchuria is different. If the new railways are built with the proceeds of Japanese loans the materials will be purchased in Japan. If we want our share of this business, we must participate in supplying the funds, either direct, through Japan, or in combination with other powers.

This leads us to our final thought on the "open door" in Manchuria. It is clear that we have little to worry about in the ordinary lines of trade. We may lose a little here and there but will make it up in other more important lines in which we hold a quasi-mono-

poly, such as oil, tobacco, automobiles, trucks, road-building and agricultural machinery, with our assured share of the electrical business and a fair share of the orders for mining, flour milling, refrigerating and other industrial plant and equipment. With any kind of good government, maintenance of law and order, recognition of the fundamental rights of the people as human beings, a stabilized currency, disbandment of locust armies and suppression of banditry, the Manchurian market will develop by leaps and bounds and surpass in importance even the main market of China Proper.

Japan will get her share of this business. Nobody can stop the operation of the fundamental economic law which gives her this preference. Even if she was able to monopolize all the trade of Manchuria, we would still benefit, as the resultant prosperity in Japan would compel her to buy more and more of our raw and partly finished products. But Japan will not monopolize the market. She will, however, get the lion's share. And as Japan prospers she will increase her purchases in the United States and we will make ten times more in this business what we may lose by the disappearance of the old order of things. Prosperity in Manchuria spells prosperity in Japan and Japan's prosperity will add to our own. The example of a rich, prosperous, well governed autonomous Chinese state, will have a stimulating effect upon the rest of China and even on Soviet Russia. Five years of good government in Manchuria under the protection and guarantee of Japan (or of the League) and the new state will have to enact rigorous exclusion laws to keep the other Chinese and the Russians out.

### A Glimpse into the Future

Although it is perhaps premature to say anything about it, when the initial political difficulties surrounding the formation and recognition of the new state are overcome, the new rulers will devise a program of development extending over a period of years. Such a program is certain to embrace the construction of at least 3,000 miles of new railways, 10,000 miles of highways, public works of all kinds, harbor and river improvements, land reclamation, city planning and other state-owned enterprises, calling for the expenditure of a minimum of \$300,000,000, or say \$30,000,000 over a period of ten years.

As to whether American manufacturers are to participate in this development depends entirely upon the willingness of our bankers to take over their share of financing the program. If such a scheme should be accepted by the American, British, French and Japanese Groups with proper guarantees for the expenditure of the funds, supervision of construction, auditing of accounts, etc., together with equal participation in the supply of materials during the life of the loans (say 35 to 40 years), we have the answer to the "open door" conundrum, as far as the four big Powers are concerned. This is all Americans are really interested in, all that we can hope to rake out of the Manchurian pot after shoving in our chips. American participation in such a program calling for \$7,500,000 a year for ten years, would return to us a market for materials worth about \$3,500,000 a year during the same period, with equal participation in the further requirements during the life of the loan. This in addition to our regular trade. This basic plan for opening up the country to settlement, the creation of extensive farms and cattle ranches, new cities, towns and villages and the great mass of smaller industries and workshops will develop a market for American manufactured materials that may and could reach \$100,000,000 in ten years.

The door to this business will never be opened by any group of Chinese officials interested solely in how many more thousands of tons of soya beans the outside world can consume and pay cash for. This hard-money goes into their own pockets while the producer receives a piece of worthless paper and a bayonet prod in his baggy trousers and told to hurry back to the farm and bring in more beans. If, for the moment, the nicely printed paper notes have any real purchasing value, however slight, the farmer may expect an early visit from the local Hunghutze chief and relieved of his wealth. Never, by any chance, will this money flow in the channels of legitimate trade other than for the purchase of the arms and munitions and the machinery to manufacture them on the ground; the official business of the bandit overlords that grease the diplomatic wheels to insure outside recognition and a perpetuation

of this crime against humanity. Japan has made it possible for these unfortunate victims of misrule to release themselves from their bondage, a service to humanity and the world at large just as lofty in its principles and motivation as those which split the American people in 1860 to give effect to our own ideas of human liberty.

Once more, Japan intends to open the door of Manchuria. Once more, Japan is staking her existence on the plains of Manchuria and Mongolia, defending herself against a menace that can no longer be ignored with safety, preserving her economic rights and facilitating her access to food supplies essential to the life of her rapidly mounting population. Japan is seeking an outlet for her prolific Korean subjects as well as for her own future generations. The United States has closed the door to the entrance of Japanese immigrants. Other white peoples in the Pacific have followed our example. There is only one region left for the Japanese and Koreans to overflow into, an outlet secured to them by treaty that China refuses to recognize or permit to be carried out.

Japan is opening a door for herself in Asia and the nation or nations that combine to stop her will have to wage war with a desperate people grimly determined to fight for their right to exist. Japan may or may not be going the right way about it to meet with the American conception of how these things should be done. Are we to constitute ourselves into a judge of her actions? Probably other nations reserve judgment about our own methods in the Caribbean, but they are sensible and courteous enough to remain silent and acquiesce in the inevitable.

Once before, Japan opened the door for us in Manchuria when we would not fight to uphold our own doctrine and in doing so, presented us with a market that transcended in importance those obtained by severe diplomatic pressure in carving out spheres of influence in other parts of China proper. Once again, Japan is fighting to reopen that same door now closed to legitimate trade expansion by Chinese official extortion and rapacity, and once more, if we permit her to solve her own problems in her own way, she will present to us a market that in ten years will surpass in importance our business in China Proper.

Are we going to hamper Japan in opening this door by quibbling over the interpretation of treaties that in no way restrict her right of self-defense? Are we foolish enough to believe that any set of treaties no matter how sacred and binding, or the threat of force, direct or indirect, can stop the operation of the tremendous human forces at work in Asia, the rapid multiplication of races whose conception of morals is based on ancestor worship and a procreative mania, such as the West cannot conceive of? Can we stop the Koreans from doubling their numbers in 23 years, seven times as rapidly as the white man? Can we stop the 90,000,000 human beings within the Japanese Empire from increasing at the rate of a million, or, with the Koreans, two million a year? Must we repeat the mistake of 1914 and combine with the rest of the world to crush a people without an outlet and whose only crime is an undue fecundity and whose necessities compel them to industrialize and compete with us in the markets of the world in order to eke out an existence? We did that to Germany. Will we do it to Japan?

Americans have no quarrel with Japan over the "open door" for trade. We challenge any American official or Far Eastern expert to refute our facts and our reasonable deductions from the facts and the figures quoted. We do not need a battle-fleet and naval bases in the Pacific to enforce a doctrine, which on analysis reduces itself to a right on our part to give away money and continue in business as a charitable institution. We do need a fleet and some armed forces in China to guard the exit once we have wandered inside the enclosure: we do need a river gun-boat patrol to protect our shipping against pirates and bandit soldiery and to rescue any American child crying on the banks of the Yangtze for protection. The father of six good American children has been in the hands of the Yangtze bandits for nearly a year and a half and his cry has not yet reached Washington.

It is China's obligation under the Nine Power Treaty to keep the door open for American trade and it is squarely up to China with her armies numbering three million men to fight her own battles, the League Covenant, the Nine Power Treaty or the Kellogg Pact to

the contrary, notwithstanding. Any fair analysis of the open door doctrine will reveal that it is simply a bogey, a tradition of our State Department trotted out on every occasion to justify our intervention in Far Eastern affairs and to extract appropriations

from a reluctant Congress for more warships. It is a good enough policy if we can uphold it by diplomacy, but it is not worth the sacrifice of one American soldier or sailor or the expenditure of one good American dollar to enforce.

# The Tragic Ending to a Daly Opera

Reflections on Reading "The Rise of Herbert Hoover" By Mr. Walter W. Liggett.  
Published by The H. K. Fly Company, New York

They are used to polite controversy and at times understand even the classic Chinese interchange of political amenities. They are past-masters of the art of vituperation and invective, of tracing the progenitors of an opponent back to the paleozoic age in such flowery hyperbole that it sounds almost like a compliment. Unless the other fellow can expiate in correct academic phraseology on the biological ramifications of the family and clan of his traducer, he loses face.

Oriental proficiency in the art of slander, inuendo and distortion of truth is surpassed by a Mr. Walter W. Liggett, who hands an old-fashioned Chinese stink-pot to President Hoover concealed in a basket of roses dedicated to George Washington. For fear that someone may pick the bouquet to pieces and disclose the filth before the Convention meets, the donor limits quotations from his masterpiece to two hundred words. It is a pity the book itself was not compressed into the same space. Mr. Liggett might have confined his thoughts about the President to a page of dots, dashes and asterisks and facilitated the work of the reviewer. It would not require even a line of such type to express a courteous and direct opinion of the book, while an estimate of the author could have been shortened to a few dashes.

Mr. Liggett is a political sewer inspector whose qualifications for the odiferous distinction may be gathered from the titles of his previous investigations such as "Bawdy Boston", "How Wet Is Washington", "Holy, Hypocritical Kansas", "Pittsburg, Metropolis of Corruption", "Vice In Volsteadland", "Ohio, Corrupt and Unashamed", "Whoopee in Oklahoma", "Michigan, Soured and Serene", etc.

In his present journey into the realms of Pluto, the explorer has endeavored to collect and identify his finds to "fill in the blank spaces in Hoover's official biography," staking his reputation as a specialist on the accuracy of every essential statement in his report. He has labored hard at his profession and accumulated a lot of sticky material, but we doubt if anyone will desire to engage in a controversy with an adversary so well armed, unless he has a bath tub ready to plunge into. Mr. Hoover's career in other parts of the world as mining engineer, Relief Commissioner and Humanitarian may or may not be open to criticism. That part of Mr. Liggett's story is no concern of ours. But Mr. Hoover's experience in China to which Mr. Liggett devotes four chapters and over sixty pages is another matter.

The author harps on an old, out-worn theme and attempts, as others of his ilk have also done in recent months, to bolster up and infuse new life into an ancient falsehood, which was exposed as long ago as the time in 1928 when Hoover was a candidate for the presidency. The attack upon Hoover at that time took the form of an article published in a political weekly at Washington based upon reports of the case tried before the High Court of Equity in London in 1905 and the decision handed down in this case. Interests then opposing Hoover had this printed in the *Congressional Record* along with the decision of the court. This elicited prompt response from Hoover's friends. Senator Lenroot of Wisconsin, who went over all the evidence in the case, wrote a letter to Congressman Free of California, reviewing the legal aspects of the case and exonerating Mr. Hoover from any improper connection with the deal, a conclusion eminently justified by the facts. This was also reprinted in

the *Congressional Record* and was supplemented by a letter of the same nature from Baron de Cartier, former Belgian Ambassador in Washington and, during the Boxer Rebellion and the years immediately following, Belgian Chargé d'Affaires in Peking.

The charges thus long ago have been weighed at Washington and this record has been available to those present-day writers who proclaim pious motives of "patriotism" for the queer things they do. One such, characteristic of the breed, was dealt with in *The Far Eastern Review* of last June. This author, John Knox, in his "Great Mistake," as the book was called, had the engaging effrontery to press President Hoover to explain what has been explained. He, too, devotes much labored effort to Hoover's experiences in China and his connection at that time with the Kaiping Mines, drawing upon the London court case as a source of innuendo. This later writer, Liggett, in his book published by the "Fly company," follows along the same twisted trail.

It is superfluous to follow in detail or even to quote from Mr. Liggett's accusations, inuendos and arraignment of Mr. Hoover over the Kaiping Mining Deal. It is an old story. Probably we know as much about this transaction as any one outside the few surviving principals. We were here in China during all the excitement, agitation and bitter criticism over the sale of the property and the subsequent trials before the courts in London for the fulfilment of the Memorandum of Transfer. We followed the progress of the case with attention and interest not only for the international politics involved but because the honor of an American was at stake.

The verdict of the British judge and his gratuitous reflection on the good-faith of the defendants was remembered when all the other facts in the case were forgotten. Sometime during the summer of 1906 when the case was under consideration in the high court of appeals, the largest Chinese shareholder in the old Chinese Engineering & Mining Company (Mr. Tong King-sing) sent to our office a long memorandum covering the Chinese side of the case with a request for its publication under a guarantee to purchase several thousand copies of the magazine at a very attractive price. After submitting it to our legal adviser, he decided that it was libellous and inaccurate and we declined to publish it at any price. Further evidence concerning the deal that subsequently came into our possession convinced us that there were too many sides to a case that could never be clarified until the inside political history of that period was revealed.

## Factors in the Situation

On its face, the Kaiping Mining Deal was a highly complicated commercial proposition, but behind the business transaction, pulling the wires at every move, were powerful international political forces engaged in a life and death struggle for the mastery of Eastern Asia, a struggle between Russia, France and Belgium working secretly with China on the one hand and with Great Britain on the other, into which Japan was eventually drawn. Without a proper knowledge of these hidden influences, the Kaiping Mining Deal can never be understood. There are few experts alive to-day competent to piece together the inside story of that deal and understand what it was all about.

If a young American geologist twenty-four to twenty-six years of age, three years out of college, struggling to make good in his profession and hold his job, could be connected with these secret international moves, or if it could be proven that he had an inkling of what was transpiring behind the scenes then he might be fairly criticized for working with and advancing the interests of a group of international financial sharks acting as the agents of Russia to carry through her program of conquest in China. By 1900, this group had obtained the Peking-Hankow Railway concession, the Hankow Iron and Steel Works and concessions in Tientsin. In order to complete their plan for a north and south trunk railway that would split China in half and enable Russia and France to oust Britain from the Yangtze Valley, they secured the share control of the American concession for the Canton-Hankow Railway, kicked out the American managers, engineers and employees and brought upon the United States the most serious set-back in its relations with China. The same group were reaching out for the Kaiping mines and harbor at Chinwangtao to consolidate the strategic position of their Imperial Russian paymaster. When even the State Department didn't know what was going on, it can hardly be expected that a kid engineer knew what it all meant.

Mr. Liggett goes very carefully into many points of evidence brought out at the trial in London. It seems that young Hoover actually swore at the old Chinese Director-General and made him lose face, and forcibly took possession of certain title-deeds and other documents connected with the mines. We can imagine that the young American was gifted with the vocabulary that went with his job. We never met a successful oldtime mining engineer in charge of work who didn't possess this qualification. No Sunday-school teacher or Y.M.C.A. enthusiast can run a mining camp or a construction gang unless he makes up in physique and proficiency in the manly art what he lacks in crisp verbosity. The scholarly old Chinese official probably conveyed his compliments to Hoover in a most approved Hanlin exposition on the evolution of a turtle's egg and was shocked when the red-haired barbarian broke all the rules of the game by telling him what he thought of him in concise mining-boss terminology. We know of other American engineers who came to China to build railways and who were similarly temperamental. In fact, no American engineer has ever quite met with the full approbation of the old-school Chinese official. Hoover was simply representative of the rugged individualism of his class.

Hoover did resort to strong-arm tactics in seizing certain title-deeds after the mines had been handed over to the new management. These deeds covered properties located in other ports, such as office buildings, real estate, warehouses, wharves, coal storage yards, etc. As we recall, some of this outside property was sold by the Chinese officials and the proceeds were not turned in to the company. Sales of other property were being negotiated. The only way to put a stop to this was to obtain possession of the title-deeds to all the company's properties and Hoover, knowing only too well that he could hope for no assistance by an appeal to Chinese law, resorted to direct action. After taking possession of the papers and the official seal he placed them in escrow in a foreign bank. Fair enough.

### Regarding that Payment

It is superfluous to reproduce the facts concerning the Kaiping Mining Deal which appeared in the November 1928 issue of this magazine. It is a much better and more accurate story than the one dug up with such "painsstaking patriotism" by Mr. Liggett. We could have added to that story and clarified the international political background, but it would not have been fair to Hoover. The only point not clear to us at that time was just how much Hoover personally profited from the deal. Mr. Liggett alleges it was 50,000 one pound shares, that is £50,000. If that is all, he was underpaid. It is an unwritten law in London, and even in America, that anyone who brings in business to a firm is entitled to at least five per cent of their profits and in cases of company promotion, even more. The new Chinese Engineering & Mining Company, Ltd., was capitalized at £1,000,000 and debentures were issued up to £500,000. Hoover was entitled to five per cent of the shares and it was paid to him without a quibble. The British are like that. He should also have received an additional gratuity

from those who profited from the debenture deal. Hoover was then permitted to purchase a small interest in the firm of Bewick, Moreing & Company and we imagine that he needed the C.E. & M. shares to buy this partnership, as his personal savings up to 1901 did not exceed \$30,000.

Like many others ignorant of how things are done in China, Mr. Liggett stresses the point that while Hoover was drawing pay as Adviser to the Chinese Imperial Bureau of Mines he was also in close touch with his firm or principals in London, the inference being that he was disloyal to those who employed him. Why pick on Hoover? It would not be difficult to draw up a list of foreign advisers employed by the Chinese Government whose first allegiance was elsewhere. We even know of disinterested experts who advise the Chinese without compensation! The inside story of Chinese advisories would make much more interesting reading than the unwarranted fling at young Hoover whose principals held £100,000 in debentures secured on the Kaiping mines and were entitled not only to the preference in any future financing but to receive accurate inside information as to the value of the properties and the possibilities for their development. The contact between Hoover as mining adviser to the Chinese Government and Bewick, Moreing & Company was respectable and legitimate compared with the activities of many other foreigners who have since occupied similar posts.

Mr. Liggett falls into the error of condemning the British financier for extorting twelve per cent interest on his loan to the Chinese mining company. Here, again, we are of the opinion that Mr. Moreing was somewhat of a philanthropist in taking such a chance in a country where there were no guarantees of law and order and where in those days twenty-five per cent or more was exacted on native business loans. Try and negotiate a loan with a Chinese bank even to-day under twelve per cent! Moreing took a big chance when he loaned the Chinese £100,000 at twelve per cent in 1897. He was lucky to come out even in the deal of 1900. There were many other creditors holding bonds and notes of the Chinese Mining Company drawing interest from eight to twelve per cent or more, whose accounts had to be balanced by payment in lower interest producing debentures. As an inducement to surrender these preferred liens on the properties, they were offered a share bonus, which accounts in part for the large number of shares that seemingly went to the promoters. The whole transaction was complicated but understandable and outside of the political ramifications, was fair and equitable. There is no need for anyone connected with it to hang his head in shame. Especially Hoover, who had nothing to do with the financial end of the deal.

Mr. Hoover was in direct control of mining operations on the Kaiping properties and in charge of the Chinwangtao harbor construction from February to September 1901, a short period of six months. There is a standard wage for laborers in China averaging around twenty cents silver per day (or ten cents gold) that has not varied much in thirty years. Incredibly low as it is, it is a fair living wage in China to-day. When Hoover took over the management of the mines and labor therein he found the pay-roll carried the names of 20,000 coolies. As he could not see where the amount of work accomplished justified this number of men, he introduced the numbered brass-check system and in the first month deleted over 8,000 names from the pay-roll. Figure it out. Over 8,000 coolies at ten cents gold per day or three dollars a month, equals \$25,000 or a yearly saving of \$300,000.

### The Real Complaint of the Chinese

Right here we have the meat of the whole story, the crux of the case. The Chinese never complained about the new capitalization, the debenture issue or the methods employed in financing the deal. They never questioned the validity of the original deed of trust, Mr. Hoover's powers or the allocation of shares to debenture holders. Naturally, they didn't like it, but they were shrewd enough to understand that it was all necessary to the reorganization of the company on a sound basis. The whole Chinese case revolved around the Supplementary Memorandum of Transfer and the clause that Chang Yin-mao would enjoy the post of Director-General in China for life. All the Chinese wanted was restoration of administrative control in order to perpetuate their squeeze. Nothing more, nothing less.

The first year's operation under the new management (six months of which were under Hoover) showed a profit of nearly \$500,000 gold or ten per cent on the new capital of £1,000,000. Under Chinese management, capitalized at Taels 1,000,000 (\$750,000 gold) the company never paid more than a ten or eleven per cent dividend, say \$75,000 gold. The difference between this and the profits from the first year under foreign management, over \$400,000 gold, represented the amount the Chinese officials put into their own pockets. After the Director-General had reimbursed himself for what he paid to get the job, greased the Viceroy at Tientsin and propitiated the Throne at Peking, there was still enough left to pay the expenses of the Peiyang fleet, that is, the Chinese navy of the day. Within three years, the properties were returning ten to fifteen per cent dividends on the new capital after paying interest on the debenture issue. It is interesting to know that Hoover's brass-check system is still used in the Kailan mines. For, if this check on squeeze is ever abolished, the Chinese would not worry about recovering control of the property. They would be quite satisfied to have the foreigner put up the capital and manage the technical end of the enterprise, if they could supervise the pay-roll.

### Bias and Venom

The Kailan Mines stand to-day, an oasis of efficiency, of humane treatment of labor and commercial integrity in a desert of chaos, corruption and human slavery. They may not be entirely a monument to the engineering and administrative ability of Herbert Hoover, but they do stand as a tribute to his firmness, honesty and efficiency in grappling with and eradicating the root causes of dishonesty in China that has enabled the Kailan mining properties to survive and pay dividends to its shareholders when every other foreign enterprise in the country has gone on the rocks.

Mr. Liggett endeavors to prove that Hoover was a hard-boiled employer of labor with no regard for human life or suffering where profits were concerned, basing his indictment on an extract from a paper on the Kaiping Mines read by Hoover before the Institute of Mining and Metallurgy in London on July 19, 1902, in which, describing labor conditions, he said :

"The disregard for human life permits cheap mining by economy in timber, and the aggrieved relatives are amply compensated by the regular payment of \$30 (Mexican) per man lost. Cases have been proved of suicide for the amount, and other cases where six grief-stricken fathers claimed the reward for the same man."

Commenting on the above, Mr. Liggett says; "Putting it plainly, the above statement can only mean that Mr. Hoover as manager for the British promoters found it cheaper to pay \$30 Mexican whenever Chinese laborers were killed by cave-ins than to properly timber the mine. The amazing callousness of this statement would defy belief if it were not that the author has a photostatic copy of the paper read by Mr. Hoover."

In this, Mr. Liggett reveals his bias and venom. The extract from Hoover's paper cannot by any stretch of the imagination be construed as evidence that the system was initiated by Hoover or even practiced by him during his period of management. Hoover took over the management of the mines shortly after the Memorandum of Transfer was signed on February 19, 1901, and could not possibly have got well started on his job for another month. He left China in September of the same year and never returned. His active connection with the mines did not therefore exceed six months. In the paper read before his fellow engineers, Hoover described conditions as he found them, methods which he had to cope with and do away with. He did not fix the valuation on human life lost in mine disasters, nor could he be held to account for the system of timbering when he took over control.

Hoover's paper dealt with conditions not only in the Kaiping properties but in all other mining and industrial enterprises in China and in describing these he simply drew attention to the graft which lies at the root of all of China's misfortunes and her inability to organize a government having the welfare of the people at heart. Torpedo boats with cement plating, wooden shells painted to look like the real thing and faked ammunition with no powder, helped China to lose war with Japan in 1895. Rifle cartridges with wooden bullets and shells lacking powder have been picked up in Chapei in 1932. We have the testimony of the American aviator who led Chiang Kai-shek's bombing squadron two years ago in his war with Feng Yu-hsiang that all but one

of the "high explosive" bombs dropped on a certain unfortified city in Honan were duds. As we write this, we are informed by an American engineer of how he erected an industrial plant for a Chinese friend who started life as a coolie and made a fortune of half a million taels in two years furnishing defective props to a certain foreign operated coal mine, where the purchasing and inspection was done by the Chinese end of the management.

A million Hoovers, all the missionaries, philanthropists and educational workers in the world cannot change these basic conditions in a country where human life is the cheapest commodity, where millions have been callously starved and their women sold into slavery in order that the armies of a war-lord may live. No, Hoover did not fix the wage scale or the compensation for loss of life by accident in a country where the great mass of people live just one hop ahead of starvation. Mr. Liggett seizes on a straightforward statement of fact to buttress his own prejudiced conclusions. We have had a copy of Hoover's paper in our files since it was published. We know, however, that one of the first things he did after taking over control of the mines was to improve the timbering and mining methods then in vogue on the properties.

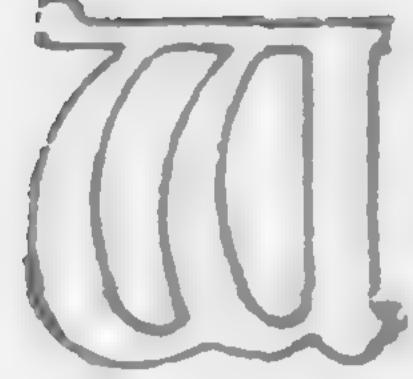
After all is said, the Kaiping Mining Deal is no different in its essentials from any other Chinese concession, agreement or contract. One group of Chinese officials affixed their signatures to the document and another group refused to permit it to be executed. It would be tiresome and unprofitable to list the repudiated mining, railway and development concessions in China or those which had a string tied to them, especially those American contracts deliberately designed to involve the American Government in a dispute with another nation previously conceded the same rights. In practically every instance where the Chinese could safely evade their contracts they have done so. Only when backed with the full weight of diplomatic support have certain engagements faithfully been lived up to.

China's present misfortune in Manchuria has its origin in her refusal to recognize the validity of her agreements. As long as there is a loophole of escape from any contract not upheld by force, China will seek to evade its provisions. In the Kaiping Deal, the Chinese handed over a deed of sale to the properties to young Hoover acting in his capacity as agent for Bewick, Moreing & Company. After the deal was put through and they lost administrative control, they loudly declared they had been tricked, that force had been used, that they had been intimidated. They carried their case to the British courts in London, but the final judgment of the High Court of Judicature after sustaining the decision of the lower court, "*stopped all further proceedings.*" The Chinese won their case in principle but could go no further. British company law could not permit a British registered enterprise to be controlled by a Board or a Director-General not elected by the Shareholders. For once the Chinese appeal to sentiment failed to work, they pitted their wits against a shrewd financial group backed with powerful diplomatic support, and lost out.

In a letter from the mines dated March 9, 1901, Hoover wrote to Moreing that "the Chinese board was a Daly opera." In these few words he correctly described the whole case and if Mr. Liggett and others of his ilk had a sense of humor, they would see the point. The burlesque has since developed into a tragedy. The story behind the Kaiping Deal was merely one of the opening chapters of a tragic farce whose conclusion is being written on the plains of Manchuria to-day.

We have probably given more time and study to the ramifications of the Kaiping Mining Deal than any of the highly paid political muck-rakers who lack that intimate knowledge of Chinese affairs and the inside political history of the period so necessary to a proper and unbiased understanding of the facts. We are satisfied after an equally painstaking investigation of all the facts surrounding that deal, that Hoover has little to reproach himself with. There is nothing that reflects in any way on his integrity or the good name of other Americans in this part of the world. If the story of the Kaiping transaction is a sample of Mr. Liggett's efforts to fill in the other blank spaces in Hoover's official biography, we are of the opinion that Hoover is rather a safe man to have as President. The events of the past six months indicate that some one in Washington has his head screwed on right. The opinion, which is fast becoming a conviction, is being driven home to us that the shoulders which support that head belong to the Man in the White House.—G.B.R.

# What of Shanghai?

 WHILE peace negotiations lag to a standstill armed forces of Japan and China hold opposing lines in the environs of Shanghai; a vast area of the city lies in ruins under a rule of bayonets; trade is paralyzed and the welfare of a community of three millions is placed in jeopardy. What does the future hold for Shanghai?

Aside from the rights and the wrongs of this situation in the fifth great port of the world, the commercial heart of Asia, a state of affairs that appears to be irremediable and that entails continued uncertainty, vexation and impoverishment for the major trading center of the Far East, has been brought about and must be readjusted as quickly as this may be done.

The possibilities for the growth and progress of Shanghai are boundless. Some faint idea of what might be achieved is to be visualized from the record of the past decade, or even from what has been done within the past five years. The ten-year period just closed has seen the growth and development of that baneful phenomenon that passes in China under the name of Nationalism, and which in its simplest essentials has come to be in recent times a doctrine to humiliate and dispossess the foreigner enunciated in a fervor of hysteria by irresponsible uncontrolled youths truant from their class rooms and directed from Moscow. The same ten-year period has seen the arrival and the absorption of the horde of Russian refugees harried from their homes and in the numerical strength of an army thrust upon Shanghai, destitute and inarticulate. It is to their credit that they have found themselves at length, but they have left their mark on the Chinese consciousness. In the same time floods, famine and pestilence have swept over large parts of China while civil warfare has been uninterrupted and more than once has been brought to the very gates of Shanghai. The communistic creed of the Slav has swept through the land like a devastating blight and is flourishing to such purpose that to-day it may be said in simple truth that the extent of communist rule in China is greater in the number of its adherents, greater in the land area over which its shadow falls, and perhaps greater in the strength of its armed effectives than in all the shadowy domain of the recognized Government at Nanking.

## The Tale of a City

With disruption, civil war, communism and chaos developing progressively in the interior of the country and with literally many millions of lives laid down in consequence of these things, more than perished in the World War, China's commercial nerve center of Shanghai, facing a future, precarious and uncertain, surmounting a business depression that yearly became more acute and then brought abruptly into consonance with the great outside world depression precisely when the silver coinage of the country was at bottom ebb, has grimly carried on. While this history has been unfolding the strength of whatever semblance of government has existed, whenever freed from the preoccupation of politics and warfare, has been exerted to hamper the foreigner, to humble his achievements and to destroy his power to mount to new heights, and the chancelleries abroad, in London and at Washington, have been passive when they have not been complaisant. Shanghai may take pride in what it has achieved. Let the traveler who saw the city ten years ago—five years ago—look at the record in reinforced concrete of to-day.

Let us imagine that assured tranquility at length has been brought to this part of the world and that all of the artificial, for they are artificial, obstacles have been swept aside into a limbo of a forgotten past. In short, imagine, if this is possible, what would be brought about if the City of Shanghai could be as untrammelled to expand and develop as any center in America or in England or on the Continent. Remembering what Shanghai has done in the past ten years in the face of every adverse influence, what prophet could put a limit to the achievements of the future?

Viewing the question from a purely economic standpoint most observers perhaps will agree that it is quite immaterial what may be the national or racial complexion of the ruling administration

in the area, whether native or alien, of pure strain or hybrid. Granted simply that the primary essentials which civilized peoples call security and good government can be assured, then no man may set a limit to the future greatness of Shanghai. If these elements which in the Occident are so commonplace that they are taken for granted might be brought into realization for Shanghai, through any agency whatever, then would set in a golden tide upon which the monumental achievements of the past would be dwarfed and, because this is China, the greatest glory and the greatest profit would redound to the Chinese.

## A Nation in Need

The times in the troubled land of Cathay to-day call out for a patriot and the only answer from the four hundred millions is the Moscow-made clamor of deluded youths unconsciously bent upon disruption. It is a basic, commonplace and widespread misconception of Chinese thought that the foreigner in this land, or the foreign powers, desire to impose an alien rule over the country and its people. The foreigner in China is and ever has been primarily a trader and as such he is reluctant to complicate his activities with the onerous and vexatious business of government. He has been able to carry out his primary aim as a trader only by taking over the unwelcome added burden of directing affairs in sharply limited spheres in order to survive at all. Extraterritoriality is an excrescence, abhorrent to the Chinese and undesired by the foreigner, which would dissolve and disappear in a space of months with the birth of a sense of responsibility and simple rectitude in the hearts of the handful of men who have been striving to direct the affairs of this country since it came to be called a Republic.

The contention of the Chinese that the treaties are obsolete is eminently sound, for the regulations that were laid down more than a half century ago for the governance of a band of expatriates on a mud flat do not conform with modern requirements, and this has been brought home with sinister emphasis to the authorities of the International Settlement by the events of recent months. What is to be done about it? Can the Chinese take over control and bring to realization all the possibilities that are here latent? The question is warranted, for exactly this has been studied and contemplated by the powers in the recent past, and a year ago it was proclaimed as a mandate of the Nanking Government. There can be but one answer, for it would be an experiment fraught with certain disaster, causing the swift uprooting of all foreign enterprise, the expulsion from the country of foreign residents and, ultimately, the submergence of the Chinese nation in a red holocaust.

## The Law of the Land

That the security of a community is inextricably bound up with the honest and fearless administration of its law courts perhaps may be accepted as a truism. In line with the efforts to comply with Chinese aspirations the powers about two years ago through their representatives in Shanghai concluded an agreement with the Chinese Government of vital importance to the community of the International Settlement, for this agreement changed the status of the courts of the community, establishing the Special District Courts completely under Chinese control. The governing body of the International Settlement had no part in this and the viewpoint of the Municipal Council was not expressed nor was it asked for. Through the period that the Special District Courts have functioned, in the opinion of foreign merchants generally, they have failed dismally, so much so that attempts on the part of foreigners to seek redress from Chinese in these courts have become exceptional and this record gives point and basis to the words of Brig.-Gen. E. B. Macnaghten, the retiring Chairman of the Municipal Council, who told the assembled ratepayers: "There was a complete collapse of the administration of criminal law in these courts with respect to offenses connected with the Japanese boycott and other anti-Japanese activities." It is a sorry commentary and quite significant as well that the leading Chinese newspapers, which should

express the best Chinese thought, while admitting all the actions ascribed to the courts, condoned these as having been "taken from patriotic motives."

In another year the agreement under which these courts function will come up for reconsideration when it is expected that some permanent arrangement will be effected, and it is devoutly to be hoped that when these negotiations are opened some expression of the views of the people most directly affected, the community of the International Settlement, voiced through their representatives, the Municipal Council, or otherwise, may be given a hearing. In the meantime, as a detail of Shanghai's present plight, the newly chosen Municipal Council is confronted by a grave financial problem in which these District Courts may become a factor. Collection of taxes through a great section of the northern portion of the Settlement is at a complete standstill. Under instruction of their various street unions and guilds the Chinese of this section are refusing to make tax payments and how these payments may be compelled is a difficulty awaiting solution.

### Just Details of a Problem

But Shanghai's financial tribulations, the question of the judiciary, and the functioning of the Municipal Council under "Land Regulations" that admittedly are outworn, all are but details of a major complex problem upon the solution of which depends the future of the port and the well-being of its inhabitants. The Chinese, having of necessity abandoned for the moment hopes for the abolition of extraterritoriality, appear to have as their immediate aim, although this is not yet clearly defined, a restoration of the so-called *status quo ante*, or a return to the conditions that existed before the Japanese occupation. From the foreign viewpoint it may be said at once that this is not desirable, and it is to be doubted very much if responsible Chinese opinion in the International Settlement actually favors a return to conditions as they have existed through recent years. Such a development in fact, should it be brought about would involve a new orientation of all activities under conditions infinitely more precarious and uncertain than they have been in the past. It is, in short, impossible of achievement.

It is necessary to face the facts and it is a reasonable conclusion that all responsible elements in Shanghai, Chinese and foreigners alike, have the same hopes and aspirations and these hopes, in a phrase, are for security and good government. When the Sino-Japanese conflict was at white heat some weeks ago a spokesman of the Tokyo Foreign Office incautiously suggested a project that involved neutral zones for the main seaports of China. This idea was damned for its parentage from the moment of its inception, but, at that, it may be found to possess a germ of value, for a neutral zone, particularly in this part of the world, after all, is a primary essential for security and there can be no security for a people ringed around with bayonets, whoever carries the bayonets. The neutral zone idea properly was rejected at Washington as a violation of China's sovereignty and as being in contravention of the policy of the "Open Door." It may be reasonable to ask, therefore, cannot this primary essential for security consisting of the complete elimination of armed forces be brought to realization through some formula that does not impair the sovereignty of China and that leaves the "open door" wide open?

If a security of this kind could be realized for Shanghai the main reason for the presence of Japanese troops in this area, as enunciated by their leaders, would be removed and these forces would have to depart. It is quite certain, too, that such a contingency would be most welcome to those who direct affairs at Tokyo, for these leaders to-day undoubtedly see the whole Shanghai adventure as an ill-starred enterprise, costly beyond all present reckoning and a transaction to be adjusted and terminated at the earliest possible moment. It is to be expected that China would uphold and carry out any new agreement to which she would give assent and therefore would exert every effort to control her own troops and hold them aloof from territory set aside as inviolate. Special measures in this connection might be found necessary, for it is simple truth, often demonstrated, that the Chinese Government's control of its many soldiers is exceedingly tenuous.

### Ways and Means

Were China freely to give assent to some program for the salvation of Shanghai worked out in co-operation with the interested

powers such an action could not by any stretch of even the youngest student's imagination be construed as damaging to the country's sovereignty, for it would be the act of a sovereign state within its own borders with all of its interests safeguarded and in all probability would give to the Government a strength and power it has never before possessed while the future prosperity and well-being of the country's main port would be assured.

Other courses which should not be offensive to Chinese susceptibilities and which meet all their conditions, are within the realm of possibility. Assuredly the foreign powers, the League of Nations, the World Court, the established foreign interests of every degree and the body of solid, responsible Chinese opinion, all ardently desire peace and order in this commercial heart of Asia, and no proposal that Chinese leaders might be moved to put forward carrying the faintest hope of security for Shanghai would go unheeded.

It is true that the reckoning between China and Japan remains to be cast up, but it grows more apparent daily that this is going to take time. Even the most ardent patriot knows that China cannot fight Japan at this time. It was a well-known young Chinese publicist, who, admitting this in a recently published article, held that while China potentially is a greater country than Japan, in the plight to which her leaders have brought her to-day, her only recourse is to make the best of a very bad condition, by temporizing as best she may, gaining strength in the meantime so as to be able ultimately to win back her own.

### A Matter of Time

This was exceedingly good advice, for most certainly China's paltry possessions to-day of massed man power and mistaken ideas would prove no match for the modern military machine of Japan, and the idea that help may come from overseas is but a vain hope. Adjustment with Japan, therefore, must take time, much time, but the losses that impend through this period of waiting from the country's storehouse of wealth on the banks of the Whangpoo definitely can be saved—if China will face the simple realities of the situation.

China can be assured of outside co-operation with any effort to effect betterments within her borders, and with this thought in mind an idea that conceivably might prove the shrewdest blow she could deal to Japan just now is put forward in all humility with the speculation what would be the reaction in China itself and abroad if the Spokesman of the recognized Government went to the League with a plain question, "We're in difficulties and we're in the market for men. We want to employ the best possible group of administrative experts to whom we may entrust for a time our most precious possession. Will you assist us in this matter?"

Could this be interpreted as a blow at the sovereignty of the country, or as a move to close the "open door?" In the past China has employed alien experts of every degree for every kind of work from the reorganization of her railways to the straightening out of her finances, and she did this presumably because she was convinced that the alien experts were better equipped to do the work in hand than any individuals that she might recruit from the ranks of her own people. It is true, of course, that a great railway system, a nation's finances and a maritime port are vastly differing entities, but if the application of a principle is sound for a railway system, and for a nation's finances, why should it not be invoked for the much more complex problem of a great community in which the values at stake are infinitely higher, so high, in fact, as to involve the actual continued existence of the nation?

It is altogether conceivable that the future welfare of the whole world may be worked out and may depend upon what happens in Shanghai. It is patent that the existing situation in the Far East may quite easily lead to another world conflagration. In any case, is it not the simple course of wisdom to take a step backward toward safety? And China can do this if China will face and acknowledge realities that are plainly apparent. If China will not face these realities, then it may be on the books that historians in the distant future seeking to trace the causes of the next great world conflict now impending will be baffled by the phenomenon of Chinese insistence and the outside world's acceptance that black is white and that two plus two equals five.

# Captain Dollar Urges Need of New Cargo Vessels\*

**A**NUMBER of large American-owned ships, built with Government loans up to 75 per cent of their cost, have been launched. This activity, however, is confined to mail vessels; the crying need now, if we are to have a balanced merchant marine and are to meet foreign competition, is to provide some Government aid in the important work of building cargo ships. It is a vital question, for our best freighters are not new and must be replaced by faster ships if we are to hold the ground we have regained since the war. New cargo ships are coming off the ways in most foreign countries, and they are faster by several knots than our fastest freighters. Aside from tankers, practically every new ship being built in this country is a combination type which complies with the requirements of the Post Office Department. Our total tonnage is growing; in 1929 we launched 126,063 tons of ships, in 1930 we launched 246,687 tons, a gain of 120,600 tons. But nothing has been done to aid the owners of freight ships—and our freighters are getting older all the time while our competitors are launching faster vessels. With the differential in cost of construction here and abroad, no private shipowner can afford to build without help of some kind.

In our coastwise and intercoastal trade we have some of the finest vessels afloat; the turbine-electric ships *California*, *Virginia* and *Pennsylvania* are models of efficiency; they set the pace for this new type of propulsion for merchant ships.

I can hardly be expected to pass by the two new Dollar liners, *President Hoover* and *President Coolidge*, without showing a certain pride. For we are very proud of these fine ships, so modern in design and so advanced in their power plants. To date they are the largest merchant ships ever built in an American shipyard; they are a credit to the Newport News Shipbuilding and Dry Dock Company, the builders, and naturally we feel that they will add luster to the Dollar Line's record.

Turbine-electric propulsion such as these ships have is still rather new in marine construction; the *California* and her two sisters of the Panama-Pacific Line were the first merchant craft to employ this type of drive. Then the Navy took it up for equipping the two airplane carriers, *Lexington* and *Saratoga*; it is a development of American engineers, but its success at sea has caused it to be adopted since by British owners for powering several large and fast passenger vessels.

The *President Hoover* and the *President Coolidge* are among the most completely electrified ships in existence; every department of the vessels have made the fullest use of electricity to give power and comfort. When it is considered that each of these ships develop 26,500 shaft horse-power for driving the twin screws, the magnitude of the liners is appreciated. Here is a brief description of the main propelling equipment of either of these craft:

Cooking and baking, lighting and ventilating, cargo handling, a hundred and one things about the ships, are done by electricity. Some improvement over the old days of coal fuel, oil lamps, and no artificial ventilation! Now we have talking pictures, radio programs, elevators, navigation equipment, clocks, and numerous other things that depend on electricity for power. Motors that drive individual auxiliary equipment are scattered all over the ships. Each vessel, for instance, has a total of 187

motor-driven auxiliaries. These are truly well named when they are called "all-electric" ships.

These new liners, which are the twentieth and the twenty-first of our fleet of *President* liners, will enter service this year in the New York-California-Orient run. The other *President* ships are turbine-driven, with a deadweight carrying capacity of over 12,000 tons. Therefore, the service of the Dollar Lines across the Pacific from San Francisco and Seattle, round-the-world, and the newly inaugurated eastbound service through the Panama Canal—all of which run on railroad-like schedule—provide the best of passenger accommodations and also give a freight service that could not be duplicated by cargo ships with their slower schedules. Commodities that do not call for particular dispatch are carried in our freighters, naturally. The fact is, the day of the tramp cargo ship is about over, save for bulk cargoes. Liners that arrive and depart from world ports on fixed hours of fixed days are giving the shipper a co-operation that the older types of vessels could not promise.

The company bearing my name was started a good many years ago, in a small way and with lumber as its backbone. I established my lumber business on the Pacific coast back in 1888, and because the supply was greater than the transportation facilities, I decided to run my own ships. We used sailing vessels and built up a great outlet for our timber products. Then we bought our first steamship, the little *Newsboy*, a lumber schooner with a capacity for 240,000 feet of lumber, and as the needs grew we added more ships. There were dark days; the period of 1907 was disastrous to many, but we were prepared beforehand and our business was not affected to any great extent. Other dark days followed; when things were pretty black for world affairs, in 1920-21, we bought more ships. You see, my faith in the future of the Pacific has never wavered, and one of my rules has been to strengthen and consolidate during slack periods so that when times are better I am prepared to take advantage of them.

But our big growth has taken place since the war. Seven round the-world liners were bought in 1923. The fleets of the Dollar Oriental service and the American Mail service running out of Seattle were purchased not long after. And now, with the Government getting behind the upbuilding of a real American Merchant Marine, we are constructing new ships. Other companies are keeping pace, and the shipyards of the East coast are humming with activity. Owing to the cost differential between the two coasts, the Pacific shipyards have not been able to secure any of this new work, but legislation is under way to provide for this differential. I should like to see the yards of every big port of America busy with new tonnage. It really looks like we are going to put the American flag on the seas in a way that we can all be proud of.

And when we are competing profitably with foreign ships, remember my dream that is so rapidly coming true: The Pacific Ocean will become the world's greatest shipping center, and the Pacific coast of North America, with its wonderful ports, will be the busiest and most prosperous region in the world.

\* Article reproduced here is taken from Capt. Robert Dollar's new book *One Hundred and Thirty Years of Steam Navigation*."



Captain Robert Dollar

# The Steel Industry of Japan

## A SURVEY

By HAROLD HUGGINS

(Concluded)

### Ferro-Alloys and Special Steels

**C**ONCERNING the manufacture of special steels in Japan there seems to be an abysmal ignorance of everything. What little is published is given below.

There are seven makers of ferro-alloys in Japan. This does not include a number of electric power companies which own electric furnaces, in which for a time they produced such alloys, as spiegeleisen, ferro-manganese, and ferro-silicon. Most of those companies have stopped production.

The makers are :

1. Yawata Steel Works
2. Kamaishi Kozan K.K.
3. Nihon Soda K.K., 3 mills
4. K.K. Tekko Sha, 2 mills
5. Nihon Kokan K.K.
6. Daido Denki Seiko Sho K.K.
7. Ogaki Denki Jikin Kogyo Sho

The principal alloys produced are in order of their importance :

1. Ferro-manganese
2. Ferro-silicon
3. Spiegeleisen
4. Ferro-chrome
5. Silicon-spiegeleisen

Production has been as follows :

	1929	1928	1927	1926	1925
Ferro-manganese	19,047	11,036	11,193	7,058	6,068
Spiegeleisen	1,210	2,011	2,138	1,811	2,066
Ferro-silicon	5,145	3,257	2,241	2,852	2,280
Silicon-spiegeleisen	68	53	46	—	—
Ferro-chrome	705	576	196	201	42
Others	160	158	198	286	86
Total	26,335	17,091	16,012	12,208	10,542

**YAWATA STEEL WORKS.**—The Yawata Steel Works manufactures :

1. Ferro-manganese
2. Silicon-spiegeleisen

Ferro-chrome was made until 1925, and until 1928, there was a small annual production of ferro-tungsten. In 1926 and 1927, there was one ton a year of ferro-molybdenum produced. The Yawata production of these alloys has never been large, the 1930 figures being :

Ferro-manganese	...	...	458 kilo tons
Ferro-silicon	...	...	273 "

This was in excess of 1928 and 1929. But the production of this type of alloy, being the product of the electric furnace, seems to have been left to the private industrialist, rather than included in the Yawata Steel Works products.

**NIHON KOKAN K.K.**—The Nihon Kokan is the principal producer of these alloys. Production follows :

Year	Ferro-manganese kilo tons	Spiegeleisen kilo tons	Ferro-silicon kilo tons
1929	11,555	950	1,700
1928	8,214	1,857	1,587
1927	7,819	2,060	428
1926	5,296	1,588	639
1925	5,964	1,619	227

There has also been a production of less than 100 tons a year of other alloys, not specified.

**NIHON SODA K.K.** (Japan Soda Co., Ltd.).—This company was established in 1920. It is one of Japan's principal producers of caustic soda, and bleaching powder. But it owns three mills, equipped with electric furnaces, in which heavy alloys of steel are produced. Its capital is Y.3,600,000, of which Y.1,950,000 is paid in. It belongs to the Mitsui group of companies.

Its three mills are :

1. Aizu Mill, producing ferro-manganese, spiegeleisen, ferro-silicon.
2. Nippongo Mill, producing ferro-manganese.
3. Toyama Mill, producing ferro-manganese and ferro-silicon.

Production at the different mills has been :

1. AIZU MILL—	1929	1928	1927	1926	1925
Ferro-manganese	1,364	902	1,300	845	492
Spiegeleisen	97	—	—	—	197
Ferro-silicon	359	172	147	367	378
Total	1,820	1,074	1,447	1,212	1,067

2. NIPPONGI MILL—	1929	1928	1927	1926	1925
Ferro-manganese	1,236	—	—	—	—

3. TOYAMA MILL—	1929	1928	1927	1926	1925
Ferro-manganese	427	374	—	—	—
Ferro-silicon	190	206	—	—	—
Total	617	580	—	—	—

**K.K. TEKKO SHA** (Steel Industry Co., Ltd.).—This company was organized in October 1928, and is comparatively new in the field of special and alloy steels. Its capital is Y.150,000, all paid in. It owns three mills all in Fukushima Prefecture.

In the Ono Shinmachi Mill the company has produced :

Material	1929	1928	1927	1926	1925
Ferro-manganese	1,937	1,246	1,320	663	22
Spiegeleisen	163	143	73	170	155
Ferro-silicon	1,582	954	856	645	432
Silicon-spiegeleisen	68	53	46	—	—
Others	21	14	20	—	—
Total	3,771	2,410	2,315	1,478	609

The Miharu Mill is only a small one newly opened, which produced in 1929, 96 tons of "other" alloys.

**DAIDO DENKI SEIKO JO K.K.**—The Daido Electric Steel Works, Ltd., is an old firm, established in August 1916. It uses the electric furnace in producing both ferro-alloys, and special steels. Its capital is Y.2,800,000, all paid in.

The mill at Atsuta, in Nagoya, is equipped with one 10 ton and one five ton electric furnace, and these are used for producing ferro-alloys, castings, etc. The mill at Tsukiji in Nagoya is used in the production of special steels only.

Production of ferro-alloys at the Atsuta Mill has been :

Material	1929	1928	1927	1926
Ferro-manganese	659	152	230	89
Spiegeleisen	—	11	5	53
Ferro-silicon	—	113	133	244
Ferro-chrome	305	576	196	145
Total	964	852	564	531

OGAKI DENKI YAKIN Kogyo SHO. (Ogaki Electric Metallurgical Industries Mill).—This is a newly organized concern which began operations in 1929, making ferro-alloys: Production in that year was:

1,500	kilo tons of Ferro-manganese
1,050	„ „ Spiegeleisen
400	„ „ Ferro-chrome
<hr/>	
2,950 kilo tons.	

This 400 tons of ferro-chrome places this company in the lead of all Japanese manufacturers of that alloy.

KAMASHI KOZAN K.K.—This company also manufactures ferro-alloys. But the production is limited. In 1927 and 1926 it produced a few tons of ferro-tungsten, and ferro-molybdenum, but has not continued to make them. Probably the demand in Japan has not yet made it sufficiently attractive for the domestic makers to specialize on making these very difficult alloys.

There seems to be in general a decline in demand for spiegeleisen, and makers are turning their attention to ferro-manganese and ferro-silicon, instead, as well as to the new alloy, ferro-chrome.

Kamaishi Kozan's production has been:

Material	1929	1928	1927	1926
Ferro-manganese	369	7	60	8
Ferro-silicon	264	49	351	602
Ferro-tungsten	—	11	7	14
Ferro-molybdenum	—	—	1	1
Others	—	54	—	—
<b>Total</b>	<b>633</b>	<b>121</b>	<b>419</b>	<b>625</b>

(On the subject of ferro-molybdenum, the reason the old Japanese sword blade were so wonderful, was that by some accident the ores used by the great masters had a slight admixture of molybdenum in them. It was the presence of this metal in the Japanese sword blade steel that made it possible to forge each piece 64 times over and produce such wonderfully strong steel.)

FUJITA KOYO K.K. (Fujita Mining Co., Ltd.).—This company is not listed by the Department of Commerce and Industry as a maker of alloys. But the Department of Communications lists it among the electro-chemical companies producing ferro-chrome in the electric furnace. The company has a capital of Y.30,000,000, of which Y.15,000,000 is paid-in.

IMPORTS OF FERRO-ALLOYS.—Imports of ferro-alloys for 1928-1930 were:

Material	1930	1929	1928
Ferro-manganese	2,131	2,468	2,122
Ferro-silicon and silicon-spiegeleisen	60	396	1,275
Other alloys	559	344	291
<b>Total</b>	<b>2,750</b>	<b>3,208</b>	<b>3,688</b>

It would appear that the business of making special steel in Japan has only just begun. Imports of ferro-alloys, which can not be made in Japan will probably increase in the next few years. At least, until the Japanese manufacturers are able to make sufficient to satisfy the demand.

### Special Steels

In the last few years the Japanese have made great progress in the making of special steels. To-day they produce high speed steels of all kinds, special steel for making saws, ball bearings, gears, cutlery, etc., etc.

There is a growing production especially in the better grade materials. This has been largely fostered by the Government policy of using only Japanese made materials.

The principal makers of special steels are:

1. Yawata Steel Works
2. Nihon Seiko Sho K.K.
3. Tokyo Kozai K.K.
4. Nihon Tokushu Ko Goshi Kaisha
5. Daido Denki Seiko Sho K.K.
6. Komatsu Seisakujo K.K.
7. Showa Tokushu Ko. Goshi Kaisha

8. Nihon Chuzo K.K.
9. Sumitomo Seikojo K.K.
10. Kaneko Chuzo Jo
11. Osaka Seisa Jo
12. Kobe Seikojo K.K.
13. Kawasaki Sharyo K.K.
14. Mitsubishi Zosenjo K.K., Kobe Mill.  
same: Nagasaki Mill, Electric Steel Plant.  
Nagasaki Mill.

15. Yonago Seikojo K.K.
16. Anrai Seikojo K.K.
17. Karatsu Seikojo K.K.  
To which should be added  
Nihon Seiko Sho K.K., Hiroshima Mill.

The total production of all kinds of special steels has been:

1929	18,529	kilo tons	1926	18,905	kilo tons
1928	15,929		1925	8,877	
1927	10,942		1924	7,415	

YAWATA STEEL WORKS.—The Yawata production of special steel does not mean production of steel from heavy metal alloys of iron. Nor for that matter does the production in any Japanese mill mean that.

Yawata production of special steels has been:

Year	Kilo tons	Year	Kilo tons
1929	3,722	1922	358
1928	2,759	1921	638
1927	1,517	1920	987
1926	1,145	1919	1,853
1925	216	1918	4,185
1924	107	1917	3,632
1923	71		

NIHON SEIKO SHO K.K.—Also produces special steels, both in its Muroran Mill, and a mill in Hiroshima, near the Kure arsenal.

Production in Muroran:

Year	Kilo tons	Year	Kilo tons
1929	7,112	1923	5,097
1928	5,055	1922	3,807
1927	3,494	1921	10,462
1926	4,065	1920	63
1925	13,751	1919	5,281
1924	5,830		

The Hiroshima Mill has produced, in 1929, only 58 tons.

This company being especially engaged in producing steel for armaments, and arms, probably makes nickel-steel, of which no private company knows anything—unless it be this one.

TOKYO KOZAI K.K.—This company produces only small quantities of special steels. In 1929, 82 tons.

NIHON TOKUSHU KO GOSHI KAISHA (Japan Special Steel Co., Limited Liability Partnership).—Established in November 1915, this company has a capital of Y.1,160,000.

It produces special steels for making carbon and high speed drills, gears, saws, ball bearings, etc. It also makes all these products itself.

Production of all classes of special steels has been:

Year	Kilo tons	Year	Kilo tons
1929	1,282	1924	554
1928	1,804	1923	423
1927	1,357	1922	955
1926	1,263	1921	989
1925	1,157		

DAIDO DENKI SEIKO SHO K.K.—This company makes all classes of high speed steel.

Production of special steels has been:

	Atsuta Mill	Tsukiji Mill
	Kilo tons	Kilo tons
1929	1,391	83
1928	863	553
1927	873	540
1926	608	415
1925	331	96
1924	158	—
1923	75	—

KOMATSU SEISAKU Jo K.K. (Komatsu Engineering Works, Ltd.).—This company makes small quantities of special steels. It was established in April 1921, and has a capital of Y.1,000,000, of which Y.625,000 is paid in.

Production :

	Kilo tons		Kilo tons
1929 .. .. ..	59	1926 .. .. ..	83
1928 .. .. ..	166	1925 .. .. ..	8
1927 .. .. ..	98		

SHOWA TOKUSHU KO GOSHI KAISHA (Showa Special Steel Co., Limited Liability Partnership).—This company operates in Kyoto. It is newly established, and no details of its manufactures can be learned. It is known, however, that it makes almost everything that can be made, or tries to make it. It produces chrome steel, etc.

Production has been :

	Kilo tons		Kilo tons
1929 .. .. ..	206	1927 .. .. ..	56
1928 .. .. ..	250	1926 .. .. ..	243

NIHON CHUZO K.K. (Japan Casting Co., Ltd.).—This company was established in September 1920, capital Y.1,000,000, paid in Y.400,000. It belongs to the Sano group. Its speciality is steel castings, but it produces a very small quantity of special steel, for its own use. In 1929 this was 30 tons.

SUMITOMO SEIKOJO K.K. (Sumitomo Steel Works, Ltd.).—The Sumitomo Steel Works were established in June 1901, and rank among Japan's oldest steel works. Capital is Y.12,000,000, paid-up Y.9,000,000. The company specializes on the production of car wheels, axles, castings, forgings, etc.

It also produces some special steels, for its own use.

Production :

	Kilo tons		Kilo tons
1929 .. .. ..	1,081	1924 .. .. ..	376
1928 .. .. ..	554	1923 .. .. ..	752
1927 .. .. ..	153	1922 .. .. ..	233
1926 .. .. ..	290	1921 .. .. ..	682
1925 .. .. ..	868		

It is the principal maker of manganese steel in Japan.

KANEKO CHUZO JO (Kaneko Casting Mill).—This is a private concern, in Osaka, established in April 1917. It has a capital of Y.175,000.

It produces manganese steel, and acid-proof castings.

Production : 1929 .. .. ..	726 kilo tons
1928 .. .. ..	695
1927 .. .. ..	915
1926 .. .. ..	815

OSAKA SEISA JO K.K. (Osaka Chain Works, Ltd.).—This company produces a very small amount of special steel for its own use. It was established in November 1916. Capital: Y.3,000,000, paid in, Y.1,500,000.

Production : 1929 .. .. ..	19 kilo tons
1928 .. .. ..	—
1927 .. .. ..	129

KOBE SEIKOJO K.K.—The Kobe Steel Works produces high speed steels, and manufactures a very high grade of drills. It produces other articles using special steels in their composition.

Production :

	Kilo tons		Kilo tons
1929 .. .. ..	2,291	1925 .. .. ..	1,125
1928 .. .. ..	1,353	1924 .. .. ..	1,302
1927 .. .. ..	1,103	1923 .. .. ..	482
1926 .. .. ..	818	1921 .. .. ..	273

KAWASAKI SHARYO K.K.—Produces a small amount of special steel for its own use. Production, 1929, 169 kilo tons. Is the original licensee for stainless steel in Japan. (In succession to the Kawasaki Zosenjo).

MITSUBISHI ZOSENJO K.K. (Kobe Works).—The Mitsubishi Dockyard Co., Ltd., Capital Y.50,000,000, paid-in, Y.30,000,000, produces a small amount of special steel in its Kobe works, in 1929, 64 tons.

YONAGO SEIKOJO K.K.—The Yonago Steel Works, Ltd., makes crucible steel "Dove Brand," cutlery, high speed steel, etc.

Production in 1929 was .. ..	158 kilo tons
1928 .. .. ..	129
1927 .. .. ..	85

Established in March 1903, capital to-day is Y.1,250,000, of which Y.1,091,475 is paid-in.

ANRAI SEIKO JO K.K.—The Anrai Steel Works, was established in February 1899. Its capital is Y.1,000,000, of which Y.650,000 is paid-in. It produces steel for saws, cutlery, high speed steels, alloys, springs, etc.

Production is small : 1929 .. .. ..	51 kilo tons
1928 .. .. ..	160
1927 .. .. ..	40

KARATSU SEIKO JO K.K.—The Karatsu Steel Works was established in October 1917. Its capital is Y.1,000,000, of which Y.625,000 is paid-in.

It produces castings, forgings, and a small amount of special steels.

Production : 1929 .. .. ..	43 kilo tons
1928 .. .. ..	86
1927 .. .. ..	40

No itemized list of the actual kinds of special steel these companies produce is available. Most of the makers are small companies and all are very jealous of each other, so any information concerning them is difficult to obtain.

## V.—MISCELLANEOUS

1. *Forgings.*—The principal manufacturers of forgings, both rough and finished are :

1. Yawata Steel Works
2. Nihon Seiko Sho K.K.
3. Oshima Seiko Sho K.K.
4. Tokyo Kozai K.K.
5. Nihon Tokushu Ko Goshi Kaisha
6. Daido Denki Seiko Sho K.K.
7. Sumitomo Seiko Sho K.K.
8. Kobe Seiko Jo K.K.
9. Kawasaki Sharyo K.K.
10. Mitsubishi Zosenjo K.K., Kobe
11. Yonago Seiko Sho K.K.
12. Nihon Seiko Sho, Hiroshima Mill
13. Karatsu Seiko Jo K.K.
14. Mitsubishi Zosenjo K.K., Nagasaki Denki Seiko Jo.
15. Mitsubishi Zosenjo K.K., Nagasaki Mill

The total productions of forgings in these mills in 1929 was 38,450 kilo tons. Other years it was :

	Kilo tons		Kilo tons
1928 .. .. ..	31,968	1925 .. .. ..	24,743
1927 .. .. ..	25,475	1924 .. .. ..	29,586
1926 .. .. ..	24,353	1923 .. .. ..	21,840

In most of the mills the rough forgings are finished and used in the company's own machinery manufactures. This is particularly so at :

Nihon Seiko Sho  
Oshima Seiko Jo  
Mitsubishi Zosenjo

Sumitomo Seiko Jo  
Kawasaki Sharyo K.K.

2. *Castings.*—The principal makers of cast steel are :

1. Yawata Steel Works
2. Nihon Seiko Sho K.K.
3. Kamaishi Kozan K.K.
4. Oshima Seiko Sho K.K.
5. Nihon Chuko K.K. (Tokyo)
6. Nihon Chozo K.K.
7. Daido Denki Seiko Sho K.K.
8. Komatsu Seisaku Jo K.K.
9. Showa Tokushu Ko Goshi Kaisha
10. Sumitomo Seiko Sho K.K.
11. Nihon Chuko K.K. (Osaka)
12. Kabushiki Goshi Kaisha Hamuro Chuko Jo.
13. Osaka Seisa K.K.
14. Kyoritsu Denki Chuko Jo

15. Kobe Seiko Jo K.K.
16. Kawasaki Sharyo K.K.
17. Mitsubishi Zosenjo K.K., (Kobe)
18. Yonago Seiko Sho K.K.
19. Nihon Seiko Sho, Hirsoshima Mill
20. Asano Kokura Seiko Sho, K.K.
21. Tobatta Imono K.K.
22. Karatsu Seiko Sho K.K.
23. Mitsubishi Zosenjo K.K., Nagasaki Mill, Electric Steel Works.
24. Mitsubishi Zosenjo, Nagasaki Works

Total production of castings in all these mills has been :

	Kilo tons	Kilo tons
1929	.. .. 49,224	1925 .. .. 36,188
1928	.. .. 48,675	1924 .. .. 27,139
1927	.. .. 43,145	1923 .. .. 30,011
1926	.. .. 41,652	

3. *Rivets and Bolts.*—There are many small makers of rivets and bolts, but the Yawata Steel Works and the Tokyo Kogyo are the most important, with the largest production.

At Yawata in 1930 there were produced :

Bolts and Nuts .. ..	628 kilo tons
Rivets .. ..	573
Nuts .. ..	39
Dome rings .. ..	13
Rings .. ..	30

4. *Wheel Rims and Axles.*—These are produced in several mills, principally though :

Yawata Steel Works  
Sumitomo Seiko Sho  
Kawasaki Sharyo  
Mitsubishi Zosenjo, Kobe works

Production at Yawata in 1930 was :

Wheel Rims .. ..	4,381 kilo tons
Axes .. ..	2,016

5. *Window Sashes.*—These are made by Tokyo Kotetsu Seisakujo, in Oshima Machi, and the Nihon Tokushu Ko, Goshi Kaisha, mill in Oshima also.

These two companies also make springs.

6. *Penstocks.*—The only Japanese maker of penstocks is the Mitsubishi Zosenjo K.K., of Nagasaki and Kobe. In the Kobe works in 1930, 1,258 kilo tons were produced.

7. *Cast Iron Pipe.*—The principal makers are the Kurimoto Iron Works, of Osaka, and the Kubota Tekkojo, of Amagasaki.

The Kubota Tekkojo is now world famous because it obtained a contract to supply the water pipe required by the Sourabaya Waterworks, in competition with almost every other maker in the world.

8. *Sheet Piling.*—The Yawata Steel Works successfully placed in the market in March 1931, its own design of sheet piling. Capacity about 2,000 tons a month. This definitely puts an end to sheet piling imports, and is a great blow to such companies as the Siemens Schuckert Steel Works, and the Bethlehem Steel Works.

## VI.—NAILS AND WIRES

In 1929 Japan ceased to import nails. The domestic makers are now fully able to supply all the national needs and will probably be exporting soon.

The following table shows supply of raw materials for nail and wire making, 1924-1928, inclusive :

Year	Yawata Production	Private Mills	Domestic Production	Imports	Grand Total	Production (Kilo tons)	
						Production	Total
1924	.. 29,117	9,898	39,015	88,242	127,257		
1925	.. 36,232	12,964	49,196	51,319	100,515		
1926	.. 28,779	6,024	34,803	117,971	152,774		
1927	.. 49,032	5,395	54,427	109,090	163,517		
1928	.. 50,769	6,820	53,589	172,644	230,233		

In March 1926, the duty on wire materials was raised to 18% from 15% *ad valorem*. From September 17, 1923, to March 31, 1924, because of the earthquake and fire relief, there was no duty imposed.

The import supply and demand for nails and wire are given in the next two tables :

Year	Nails	Galvanized Nails	Total
1924	.. ..	37,301	1,901
1925	.. ..	591	1,409
1926	.. ..	806	1,458
1927	.. ..	500	1,797
1928	.. ..	953	1,974

Year	Wire	Galvanized Wire	Total
1924	.. ..	2,048	137,809
1925	.. ..	672	22,738
1926	.. ..	1,413	35,230
1927	.. ..	1,337	10,712
1928	.. ..	2,447	7,017

Imports in 1924 of nails and wire were large not only because of special demand but because there was no duty on them. Duty on nails was raised from Y.1.90 per 100 kin to Y.2.40 per 100 kin in March 1926. In 1926, because of the increase in duty, imports fell and an increase in domestic production followed :

Consumption of wire and nails is shown in the next table :

	1924	1925	1926	1927	1928
Wire supply ..	.. 127,257	100,515	152,774	163,517	230,233
Nails, imported ..	.. 178,959	24,738	38,902	14,346	12,624
Total .. ..	306,216	125,253	191,676	177,863	242,624

Rate of increase (excluding 1924-1925) is 14% a year for nails, and 10% a year for wire. It is impossible to estimate rate of increase in future years because of the completion of the reconstruction program, and the retrenchment policy of the present government.

Production of nails is given in the following table :

Locality	Mills	Machines	Capacity	Raw Materials Used	
				Kilo tons	Kilo tons
Kyushu .. ..	1	—	40,000	32,000	
Osaka .. ..	30	810	46,000	38,000	
Hiroshima, Nagoya, etc. ..	10	—	6,000	5,000	
Tokyo .. ..	7	170	12,000	8,500	
Osaka .. ..	50	1,500	104,000	83,500	

The largest of all the nail factories is that belonging to the Yasuda Shoji K.K., in Kyushu. Its capacity is almost half that of all the makers in Japan. It uses raw materials only from Yawata Steel Works. Other makers in Osaka rely largely on imported wire.

Wire productive capacity is as follows :

Locality	Wire Mills	Capacity	
		Galvanized	Steel
Osaka .. ..	12	3	85,000
Tokyo .. ..	1	15	15,000

Total 40 mills : Productive capacity : Galvanized wire : 100,000 kilo tons a year : Steel wire, 75,000 kilo tons a year.

Manufacturing, like that of nails, is mostly done around Osaka.

The Osano Kokura Seiko Jo makes its own wire drawing materials and produces its own wire. There are others making wires which are used in nets for reinforcing concrete roads.

Total consumption of wire is about 210,000 tons a year. But because of the large number of very small mills in this business, production can never be very stable.

## PRINCIPAL MAKERS OF NAILS IN JAPAN :

Mori Seitei Jo, Tsukiji, Amagasaki City  
Ota Seitei Jo, Tsukiji, Amagasaki City  
Ueda Seitei Jo, Hatsushima, Amagasaki City  
Showa Seitei Jo, Hatsushima, Amagasaki City  
Nakayama Seitei Jo, Osu Machi, Amagasaki City  
Umibe Seitei Jo, Hatsushima, Amagasaki City  
Marumi Seitei Jo, Hatsushima, Amagasaki City  
Amagasaki Seitei Jo, Osu, Amagasaki City  
Uwa Yujiro, Naruo, Muko Gun, Hyogo Prefecture  
Tada Seitei Jo, Naruo, Muko Gun, Hyogo Prefecture  
Ohara Seitei Jo, Oda Machi, Kawabe Gun, Hyogo Pref.  
Ueno Seitei Jo, Oda Machi, Kwawabe Gun, Hyogo Pref.

Fujiuchi Seitei Jo, Senbon dori, Nishinari Ku, Osaka						
Osaka Seisen Kojo, Matsubara, Senbon, Nishinari Ku, Osaka						
Kobayashi Seitei Jo, Sanko Cho, Minato Ku, Osaka						
Osaka Seitei Jo, Onga Machi, Minato Ku, Osaka						
Tanaka Seisen, Nankai Machi, Nishinari Ku, Osaka						
Yamamoto Seitei Jo, Taikai Machi, Konohana Ku, Osaka						
Ishii Seitei Jo, Inarin Machi, Naniwa Ku, Osaka						
Takeishi Seitei Jo, Ushigara Machi, Naniwa Ku, Osaka						
Oda Seitei Jo, Nakamichi Machi, Higashinari Ku, Osaka						
Washi Mori, Imafuku Machi, Higashinari Ku, Osaka						
Yamato Seitei Jo, Chukai Machi, Nishinari Ku, Osaka						
Wake Seitei Jo, Nakamoto Machi, Higashi Nari Ku, Osaka						
Sakano Seitei Jo, Mikkaichi Mura, Osaka Prefecture						
Mikakichi Seitei Jo, Mikkaichi Mura, Osaka Prefecture						
Hinode Seisei Kaisha, Mikkaichi Mura, Osaka Prefecture						
Settsu Tessen, Daikai Machi, Konohana Ku, Osaka						
Seiteki Shizenjo, Hatsushima, Amagasaki						
Ikeda Hozei Koba, Bonded Warehouse						
	Nails	Wire				
Total machines owned :	810	300				
Not operating	52	20				

## In Tokyo :

Osaki Koba, 2 chome, Tamachi, Shiba Ku  
 Yamada Seisenjo, Ikebukuro, 876, Nishi Sugamo Machi  
 These mills use about 2,920 tons of material a month.  
 Total capacity about 5,000 tons a month.  
 Matsumoto Seitei Jo, Hiroshima City  
 Hiroshima Tettei Sho, Hiroshima City  
 Tanaka Shokai, Toyama City  
 Yoshida Seitei Jo, Nagoya City  
 Nihon Seitei Jo, Nagoya City  
 Yasuda Seitei Jo, Yawata, Kyushu  
 About 420 machines in all, for nails, and 250 for wire.

## MAKERS OF GALVANIZED WIRE :

Inui Tessen, Amagasaki  
 Wake Tessen, Amagasaki  
 Settsu Tessen, Amagasaki  
 Nihon Aen Mekki, Denpo Cho, Nishi Yodogawa Ku, Osaka  
 Hinode Aen, Tsuru Machi, Minato Ku, Osaka  
 Yoshida Kyonosuke, Fuse Machi, Osaka suburbs  
 Showa Aen Mekki, Mokioka, Kawachi Gun, Osaka Pref.  
 Osaka Aen Mekki, Izuo Machi, Minato Ku, Osaka.

## MANUFACTURERS OF STEEL WIRES :

Tokyo Aen Mekki K.K., Suna Machi, Tokyo Prefecture  
 K.K. Hirota Seisenjo, 359, Senda Machi, Fukagawa Ku, Tokyo  
 Sugita Seisenjo, 130 Honnura Cho, Fukagawa Ku, Tokyo  
 Osawa Seisenjo, Suna Machi, Tokyo Prefecture  
 Oi Seisenjo, 2940, Nishi Sugamo Machi, Tokyo Prefecture  
 Adachi Seisenjo, Nagasaki Machi, Ikebukuro, Tokyo Pref.  
 Ichimura Seisenjo, Umibe Machi, No. 903, Fukagawa, Ku, Tokyo  
 Haneda Konkurito Kogyo Sho, Haneda, Tokyo Pref.  
 Ito Seisenjo, Kameido Machi, No. 45 of 8 chome, Tokyo Pref.  
 Ikebukuro Shokosen Seisakujo, Kamigakubo, Ikebukuro  
 Fuji Seisenjo, Isogo Ku, Yokohama  
 Yokohama Tetsugyo K.K.  
 Tokyo Seiko K.K. Kowasoki  
 Dai Schi Seisen K.K. Tonigawa Cho, Fukagawa Ku, Tokyo  
 Nihon Densen, Amagasaki  
 Kansai Seiko K.K., Kishiwada City  
 Toya Seiko K.K., Kishiwada City  
 Total productive capacity about 7,000 tons a month.

Osaka Seisen, Honjo, Kita Ku, Osaka  
 Makioka Tessen, Ishida Machi, Minato Ku, Osaka  
 Takeishi Tessen K.K. Migata Machi, Naniwa Ku, Osaka  
 Including small makers about 3,500 tons capacity in Osaka  
 a month.

## RAW MATERIALS CONSUMED IN THE JAPANESE STEEL INDUSTRY

1929— Material	Producing : Steel			Total Kilo tons
	Pig-iron Kilo tons	Materials Kilo tons	Other Kilo tons	
Iron ore ..	1,618,384	174,668	—	1,793,052
Manganese ore ..	77,070	47,044	—	134,114
Limestone ..	411,508	249,006	275	660,789

Coking coal ..	—	—	1,907,861	1,807,861
Other coal ..	1,997	630,941	1,010,774	1,643,712
Coke ..	1,204,582	46,400	24,397	1,275,379
Pig-iron ..	—	1,087,413	29,742	1,117,155
Alloys ..	191	23,904	617	24,712
Waste iron, dust, etc.	180,621	—	—	180,621
Scrap iron ..	28,928	1,183,445	19,788	1,132,159
Iron sand ..	165	156	18	339
Charcoal ..	4,073	515	969	5,557

## 1928—

Iron ore ..	1,650,499	180,150	14	1,830,665
Manganese ore ..	68,080	41,020	20	109,120
Limestone ..	438,526	201,460	474	640,460
Coking coal ..	—	—	1,797,889	1,797,889
Other coal ..	2,114	568,239	1,029,268	1,599,621
Coke ..	1,153,541	36,904	29,606	1,220,051
Pig-iron ..	—	1,041,867	27,267	1,069,134
Alloys ..	73	19,079	122	19,274
Waste iron, dust, etc.	126,716	—	—	126,716
Scrap iron ..	24,251	1,030,047	15,113	1,069,411
Iron sand ..	1,439	268	136	1,843
Charcoal ..	1,046	715	978	2,739

## PRODUCTION OF STEEL THROUGHOUT THE WORLD

Country	1929 Kilo tons	1928 Kilo tons	1927 Kilo tons		
United States ..	56,992,000	52,368,000	44,653,000		
Canada ..	1,498,000	1,259,000	921,000		
England ..	9,977,000	8,661,000	9,244,000		
France ..	9,677,000	9,497,000	8,229,000		
Belgium ..	4,170,000	3,933,000	3,703,000		
Luxemburg ..	2,707,000	2,566,000	2,469,000		
Italy ..	2,184,000	1,962,000	1,594,000		
Spain ..	965,000	800,000	670,000		
Sweden ..	685,000	576,000	498,000		
Germany ..	16,459,000	14,513,000	16,306,000		
Austria ..	650,000	636,000	559,000		
Portugal ..	543,000	485,000	471,000		
Czecho-Slovakia ..	2,184,000	2,032,000	1,874,000		
Poland ..	1,442,000	1,436,000	1,245,000		
Russia ..	4,673,000	4,257,000	3,720,000		
Saar Basin ..	2,235,000	2,072,000	1,874,000		
Australia ..	657,000	469,000	455,000		
British India ..	579,000	416,000	584,000		
Japan ..	2,293,000	1,906,000	1,685,000		
Other Countries ..	335,000	325,000	223,000		
Total ..	120,705,000	110,169,000	100,997,000		

## Russia Plans New Metal Plant

A great metal factory, second only to the Magnitogorsk mill, is under construction in Krivoi Rog, center of the ore deposits in the southern region of the U.S.S.R. To supply the needs of this mill there will subsequently be built a coke chemical plant, a fire-brick mill, a Portland cement mill and a large factory for the production of structural iron.

The first part of the mill is scheduled to produce 1,200,000 tons of pig-iron, more than 800,0

# The Origin and Development of the Diesel Engine

**H**AT the end of 1892 the mechanical engineer Rudolf Diesel approached the Maschinenfabrik Augsburg with the suggestion to create a new caloric prime mover according to his inventions and plans.

The negotiations resulted in a contract, signed on the 21st February, 1893, by which the M.A. was obliged to construct an experimental engine and to mobilize for this purpose the technical and financial resources of the Company on a very large scale. During the time from 1893 till the spring of 1897 the first "Diesel Engine" originated from the combined efforts of the M.A. and Diesel. As a matter of fact, this first engine did not correspond to Diesel's original ideas, but it was running satisfactorily and the first official tests made by Professor Schroeter of the Engineering College of Munich proved a thermal efficiency which was by far superior to any other thermal prime mover known up to that time.

As early as April, 1895, this first engine had been operated on the test bed

at Augsburg with the first positive indicator card area. This first encouraging success was the result of two years of hard effort to give Diesel's theoretical invention the shape of a practical engine. In fact the indicator diagrams of the first engine were

just contrary to the theoretical idea of Diesel's original invention, which aimed at an isothermal combustion of the fuel which was intended at the beginning to be pulverized coal but was finally lamp petroleum (kerosene). Nobody took notice of the difference between theory and practice; all efforts of those concerned in this hard and troublesome problem was concentrated in those days on the increase of the useful area of the indicator cards i.e. the thermal efficiency of the engine.

The first success, mentioned above, resulted from the application of the compressed air injection of the liquid fuel after years of failures with experiments of airless fuel injection. The official tests of the first Diesel engine—which is now exhibited in the German Museum in Munich—mentioned before,



Figs. 4 and 5.—Show the First Experimental Engine Without Cylinder Cooling Jacket (1893), and Experimental Engine of 1895 With Cooling Jacket

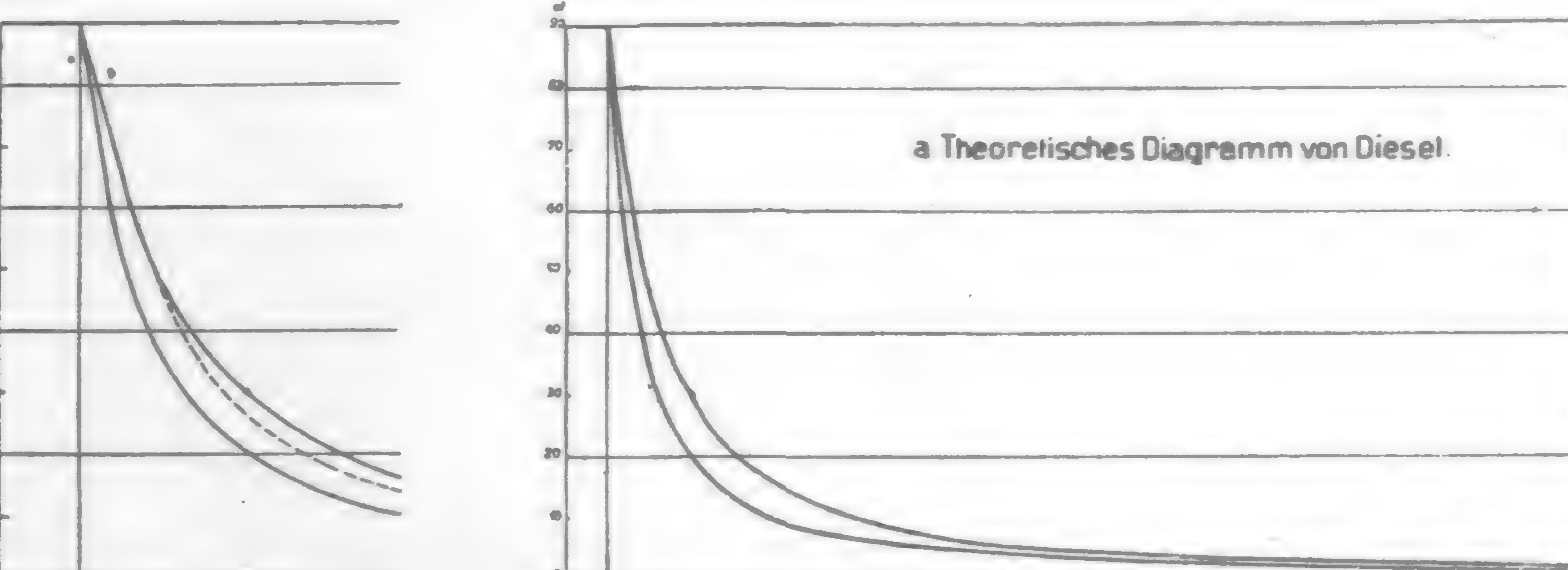
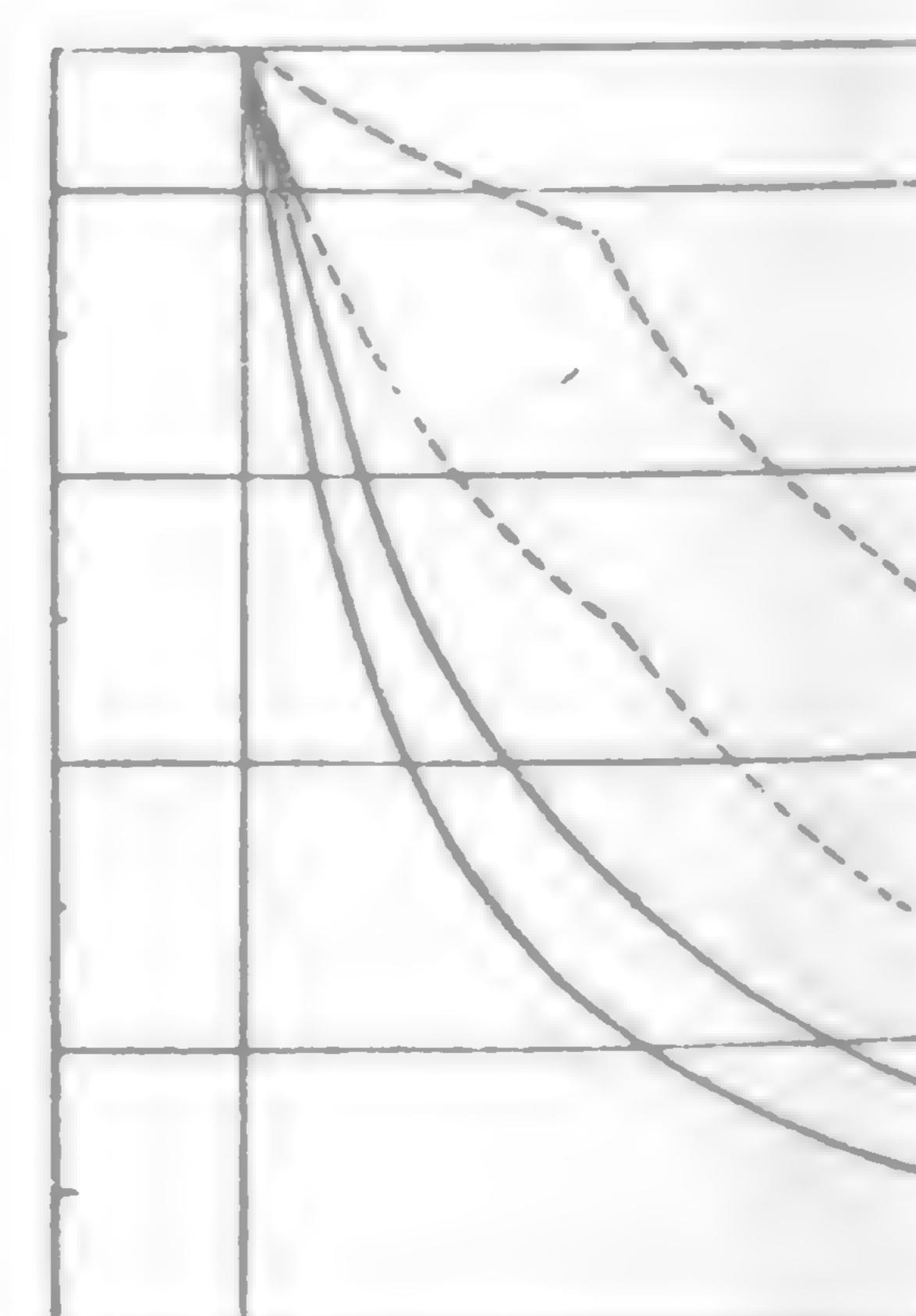


Fig. 1.—Is the Theoretical Indicator Card Aimed at by Diesel



Verlauf der Temperaturen im theor. Diagramm (a) und im Indikatordiagramm (b)

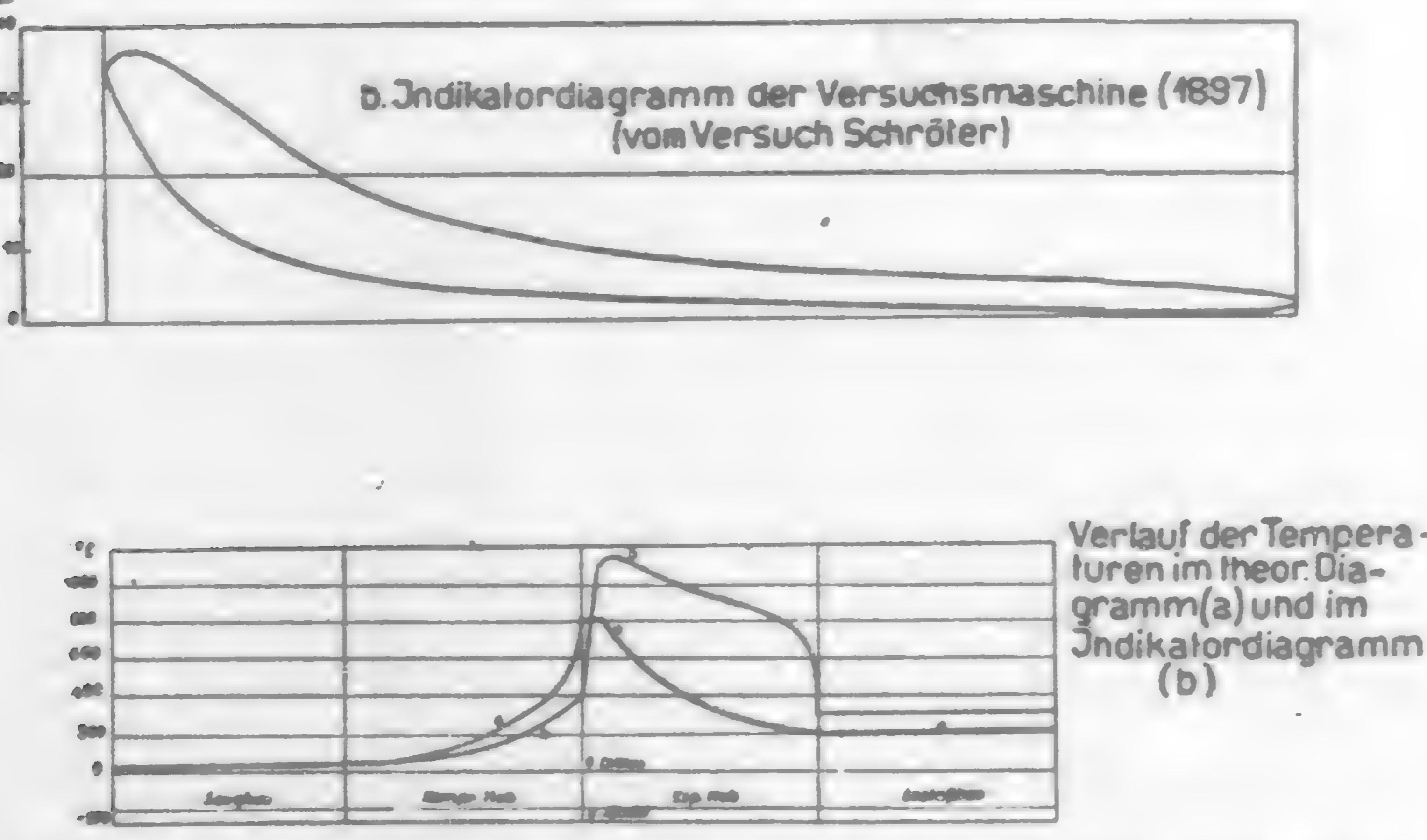


Fig. 2.—Is the Practical Indicator Card of the Experimental Engine of 1897



Fig. 3.—Is Indicator Card of Explosion Engine of 1892 Basis of Dr. Diesel's First Patent Application

had in those days the sensational result that the fuel consumption per b.h.p. hour was as low as 235 grams=0.518 lbs. which corresponds to a thermal efficiency of 26.9%.

But this engine was not yet operating reliably and safely, nor was it marketable. The M.A.—later called the Augsburg Works of the M.A.N.—was alone authorized by facts to claim the merit of having developed the Diesel engine into a really efficient and reliable engine giving satisfaction under the care of even non-professional drivers. It took the M.A.N. an enormous lot of self-contained work and heavy sacrifices of money, to realize this wonderful achievement without assistance from outside. The consequences of the first success, which were published in the engineering press, were some licenses for the construction of Diesel engines, granted to important engineering firms of various nationalities, which started without delay to construct their first Diesel engines of 20 b.h.p. in accordance with the license drawings supplied by Diesel.

Krupp and Augsburg, as patent owners in Germany, constructed larger engines of their own design. All those concerned were full of hope for further success. Papers read by Diesel and Schroeter in Kassel in 1897 caused new enthusiasm in engineering circles.

The 60 b.h.p. two cylinder Diesel engine which had been ordered previously by the Match Factory

“Union” of Kempten was intended to be inspected by experts on the test bed. This could not be done, however, before some trials had been made, causing repairs, changes and a considerable delay with this engine and of other engines ordered later. Difficulties and troubles were damping enthusiasm; uneasiness and impatience were the consequence, though nobody was aware, that manufacturing had more and still heavier troubles in store for all concerned.

Diesel wished to proceed quicker, by forming his own “Diesel-motorenfabrik A. G. Augsburg,” but trials with the experimental Diesel engine were continued by M.A.N. with Diesel's co-operation, with a view to develop the coal dust and compound Diesel engine as well as the Diesel gas engine. All efforts failed, with the exception of the progress of the normal petroleum-operated Diesel engine, which was shown by four licensees (Krupp, M.A.N.—Augsburg, M.A.N.—Nürnberg and Deutz) in a collective exhibition of four engines in Munich, without convincing success however. Meanwhile only the M.A.N. Augsburg stuck to the progressive development of the Diesel engine, though continuous troubles and breakdowns with the Kempten engine, were the subject of harsh criticism at Kempten and Augsburg. A long list of failures, breakdowns and repairs had to be dealt with, causing heavy expense and strenuous efforts of all concerned.



Fig. 6.—Shows First Efficient Diesel Engine of 1897 Tested by Professor Schroeter at Munich on February 17, 1897

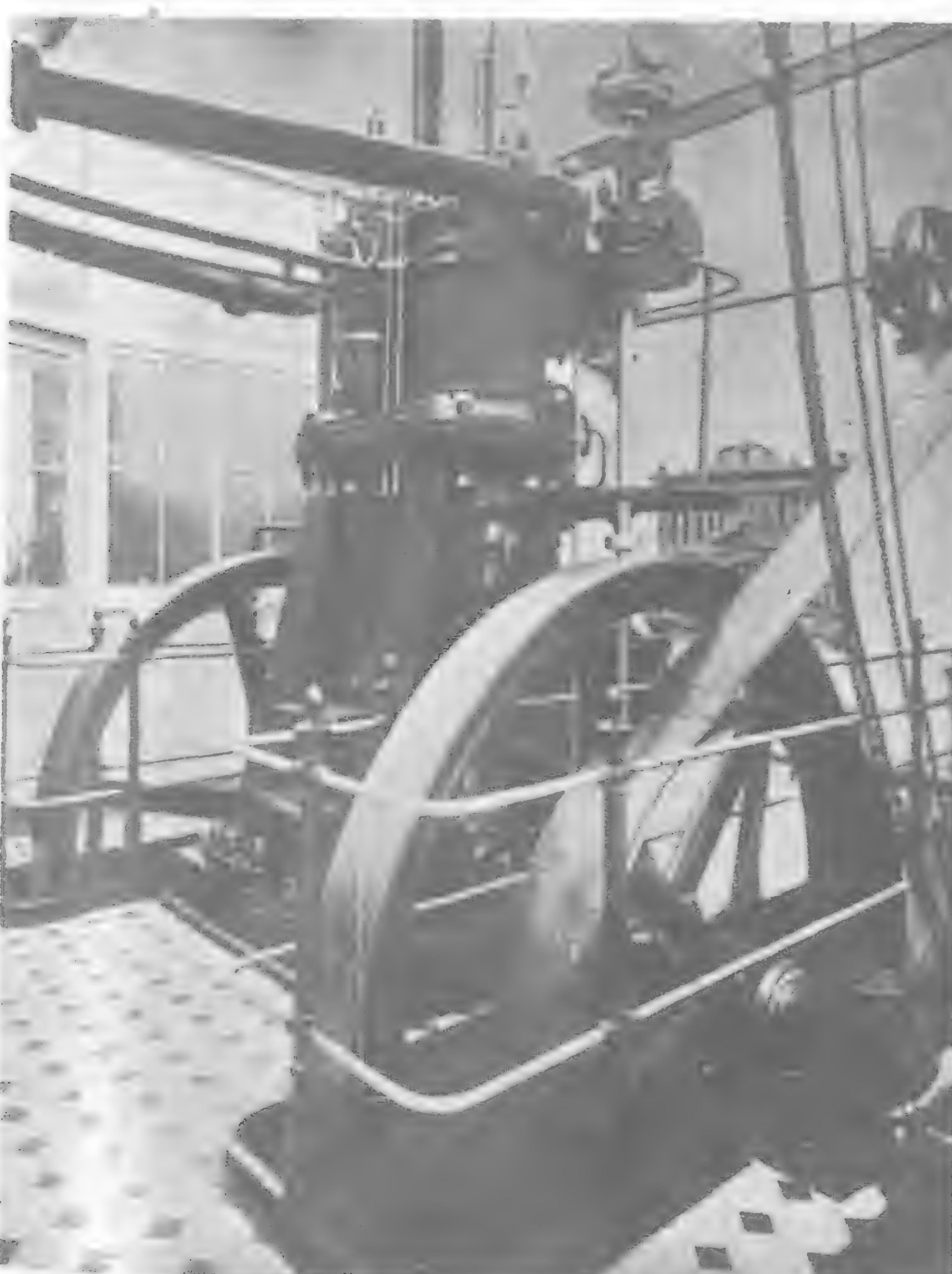


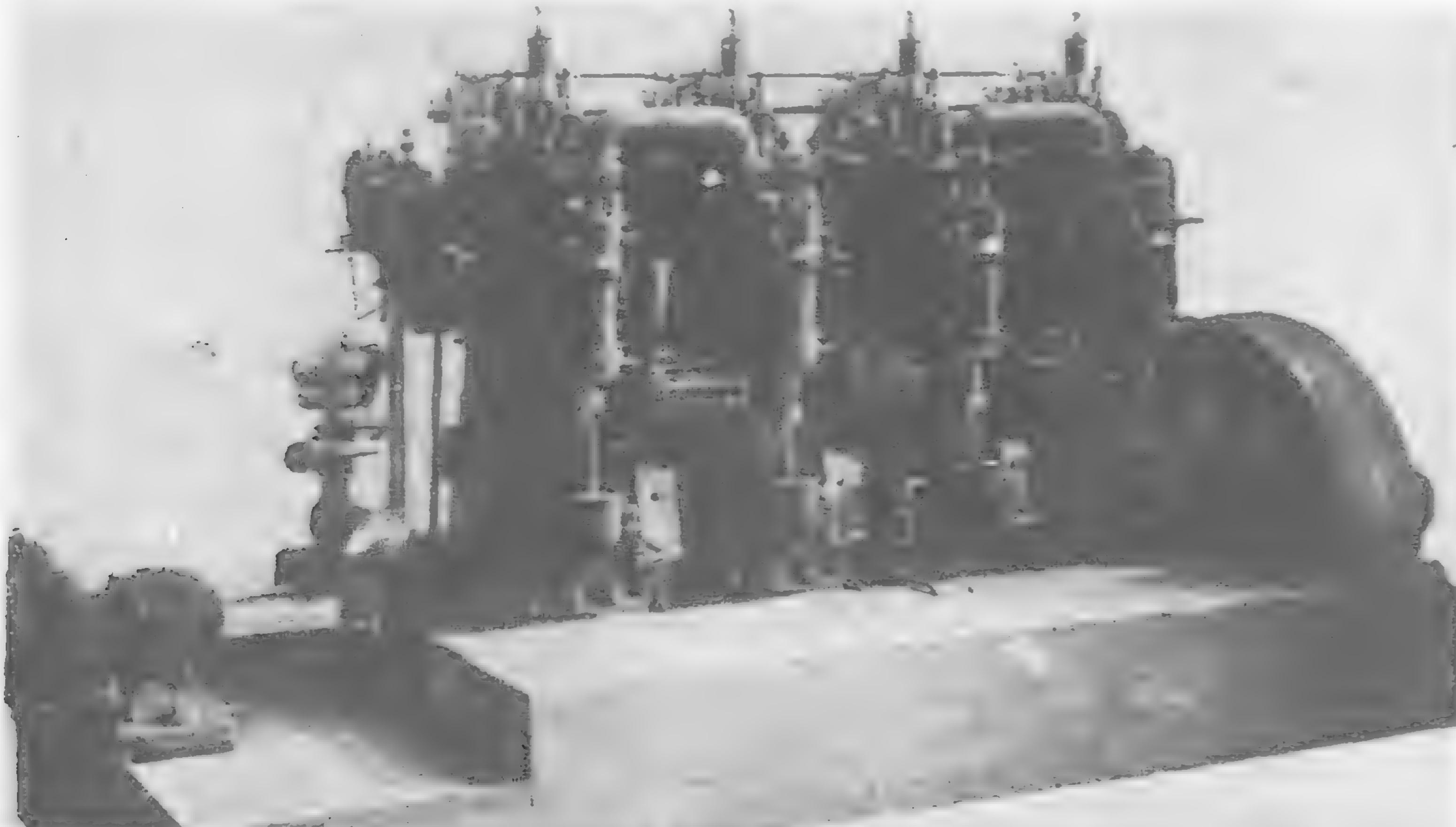
Fig. 7.—First Diesel Engine of 60 b.h.p., Supplied to Match Factory “Union” of Kempten in 1897 (15 Years in Operation, the next Engine 31 Years)



Fig. 8.—First Diesel Engine of 70 b.h.p. with Trunk Piston of 1901

During this critical time the M.A.N. was not in the least supported by anybody; Diesel himself was busy with his own undertakings, but neither his small high-speed engines nor his own production of full-size Diesel engines were successful. His "Allgemeine Gesellschaft für Dieselmotoren A. G. Augsburg" tried to start a horizontal two-stroke Diesel engine, which also proved a failure.

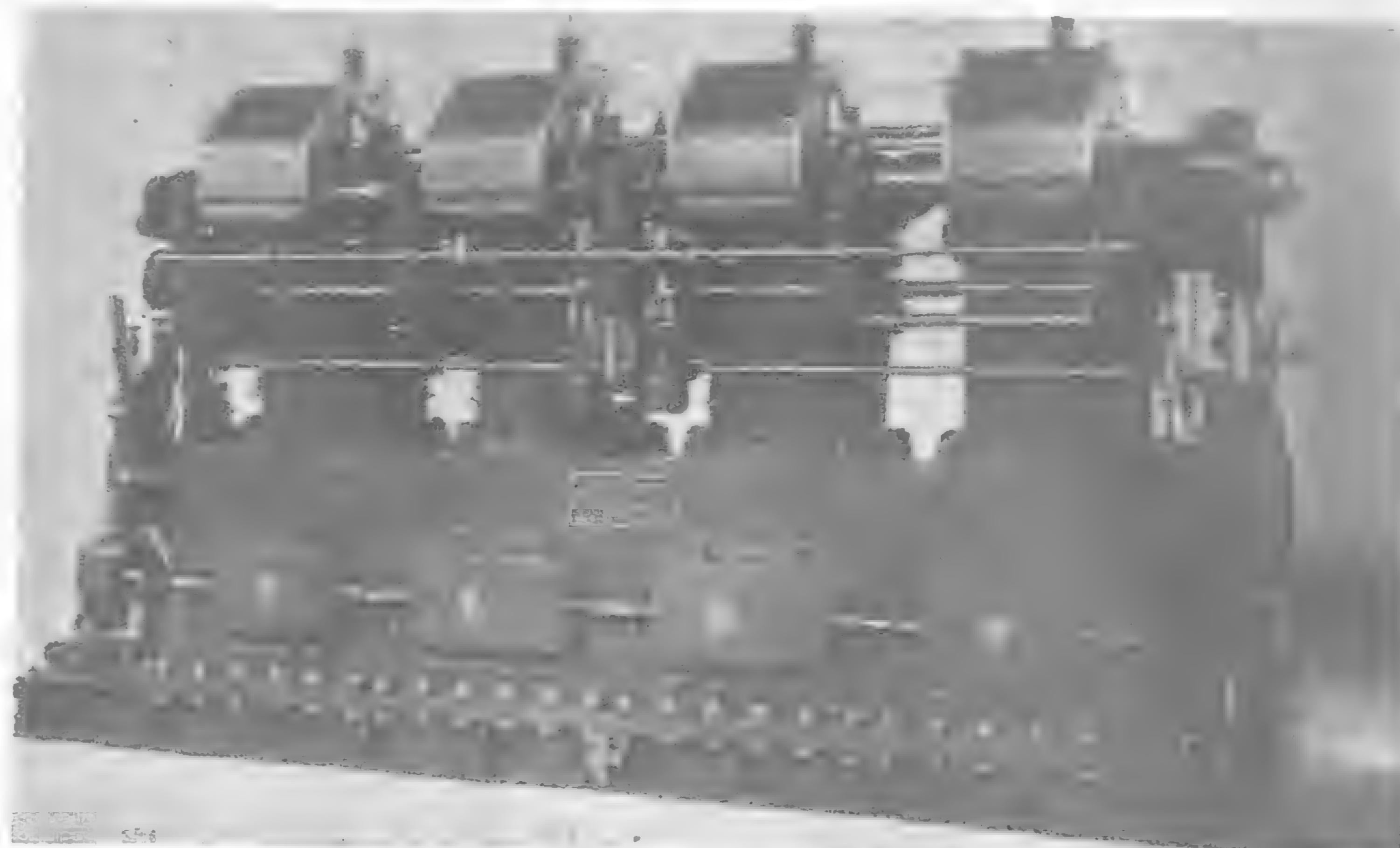
In the meantime all the licensees had been disappointed by these experiences and had given up the construction of Diesel engines.



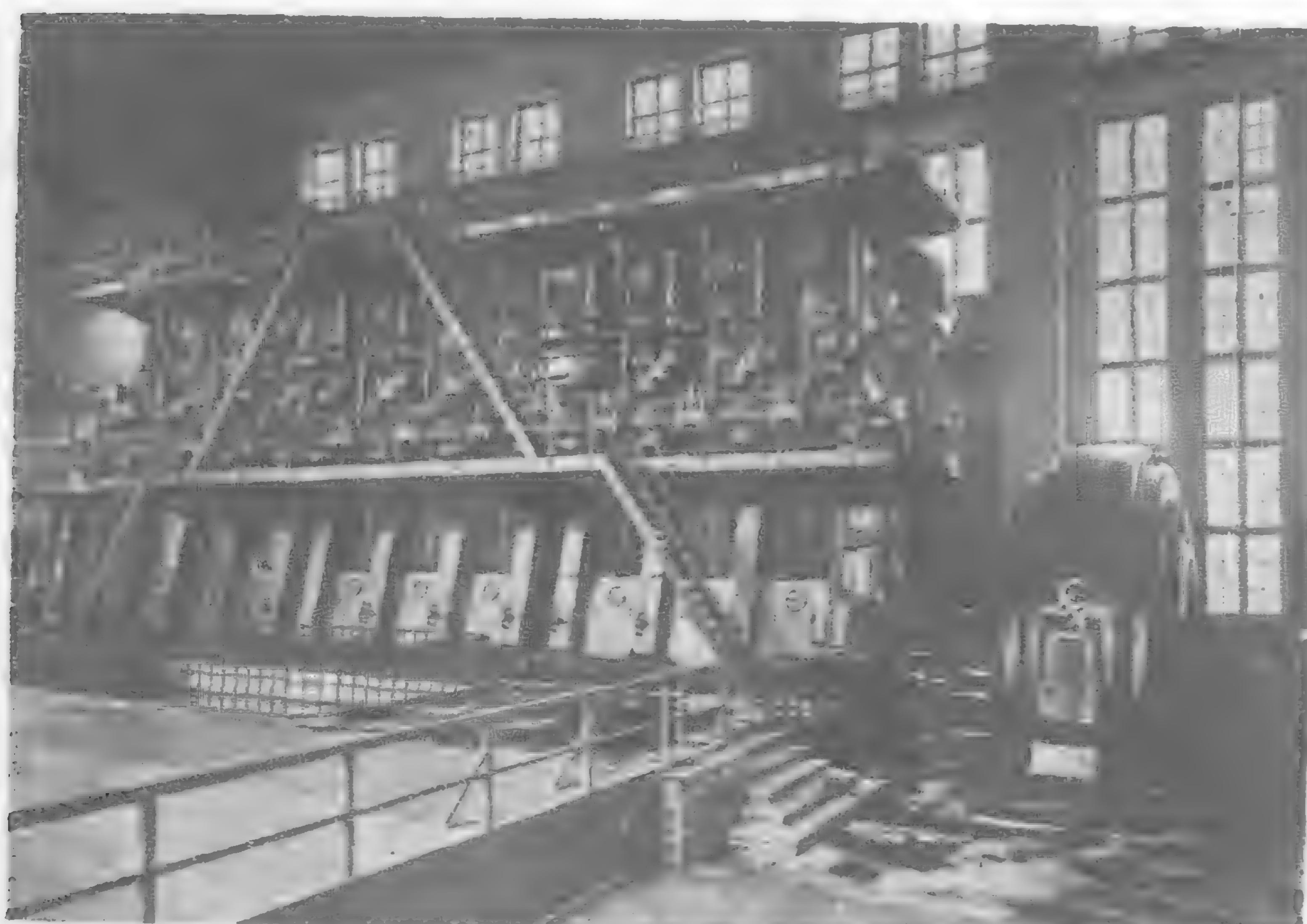
High Speed Reversible Marine Diesel Engine of 140 b.h.p. of 1902

Meanwhile little by little the Kempten engine and some new engines were working more and more satisfactorily after careful improvements of all important parts, though the general enthusiasm of 1897 had been succeeded by the worst depression of confidence and hope in 1900.

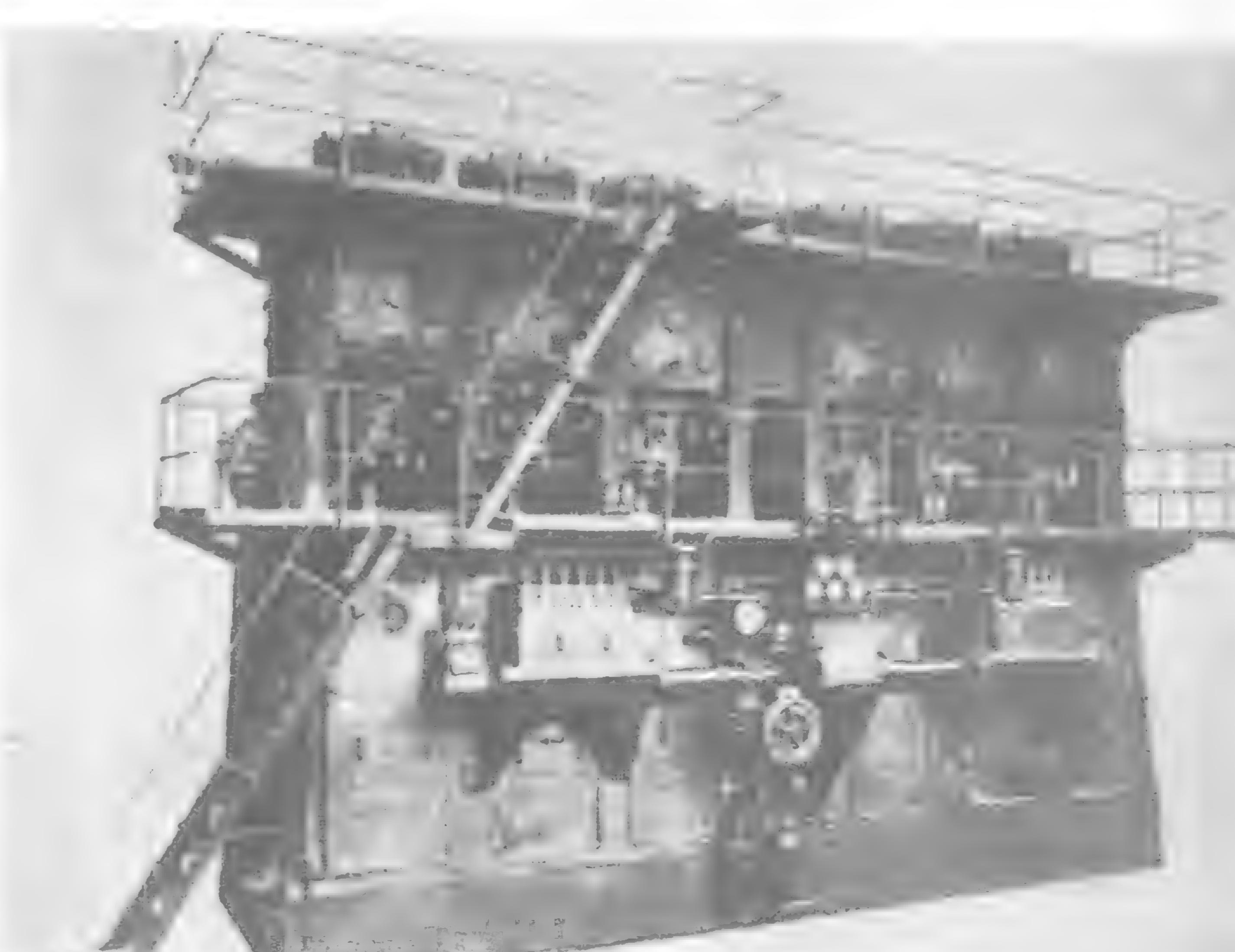
But since this turn to the better for the Kempten engine, the quick and successful development of the Diesel engine could not be stopped any longer by the opposition of antagonists. In spite of the high price and the lack of cheap fuel, 14 engines totalling 500 b.h.p. had already been ordered. In 1901/2 the Augsburg



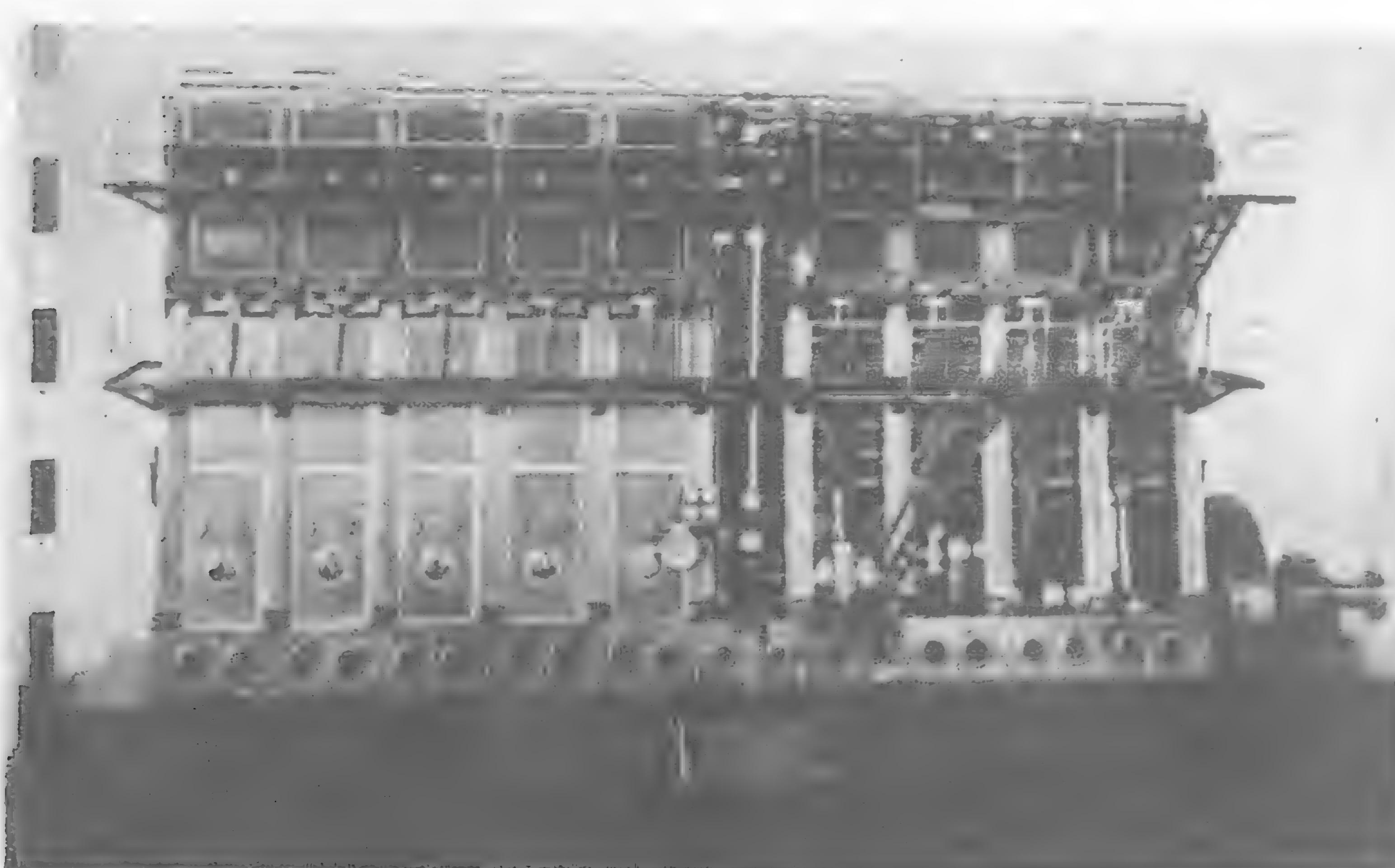
First Reversible Submarine Diesel Engine of 300 b.h.p. for the French Admiralty (1905-06)



Double Acting, Two-Stroke, 9 Cylinder Diesel Engine 15,000 b.h.p., 94 r.p.m., Supplied as a Peak Load Set for Power House of Neuhot near Hamburg



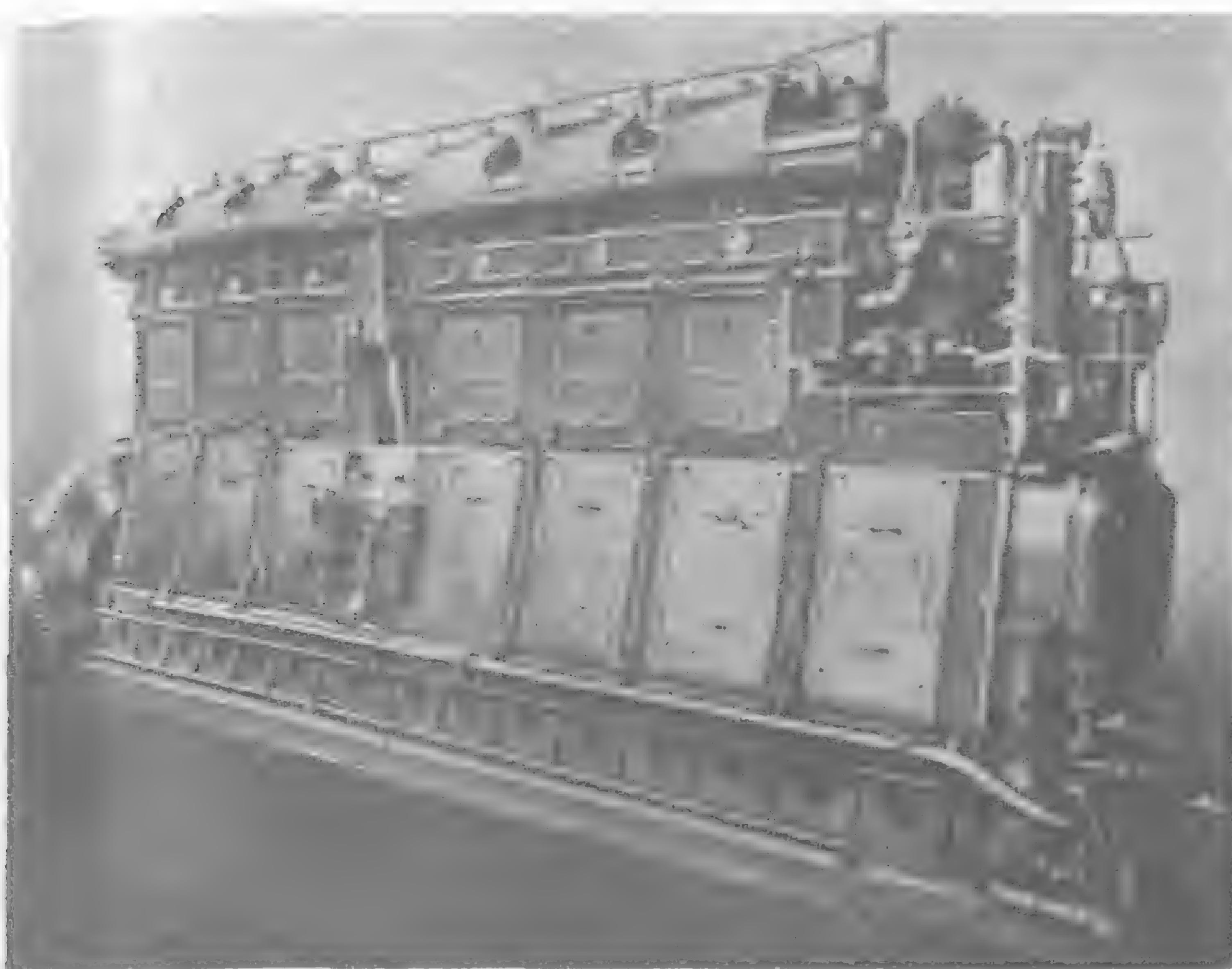
Reversible, Double Acting, Two-Stroke Diesel Engine with 6 Cylinders and Airless Fuel Injection, 4,800 b.h.p., 160 r.p.m., Supplied for Japanese Motorships



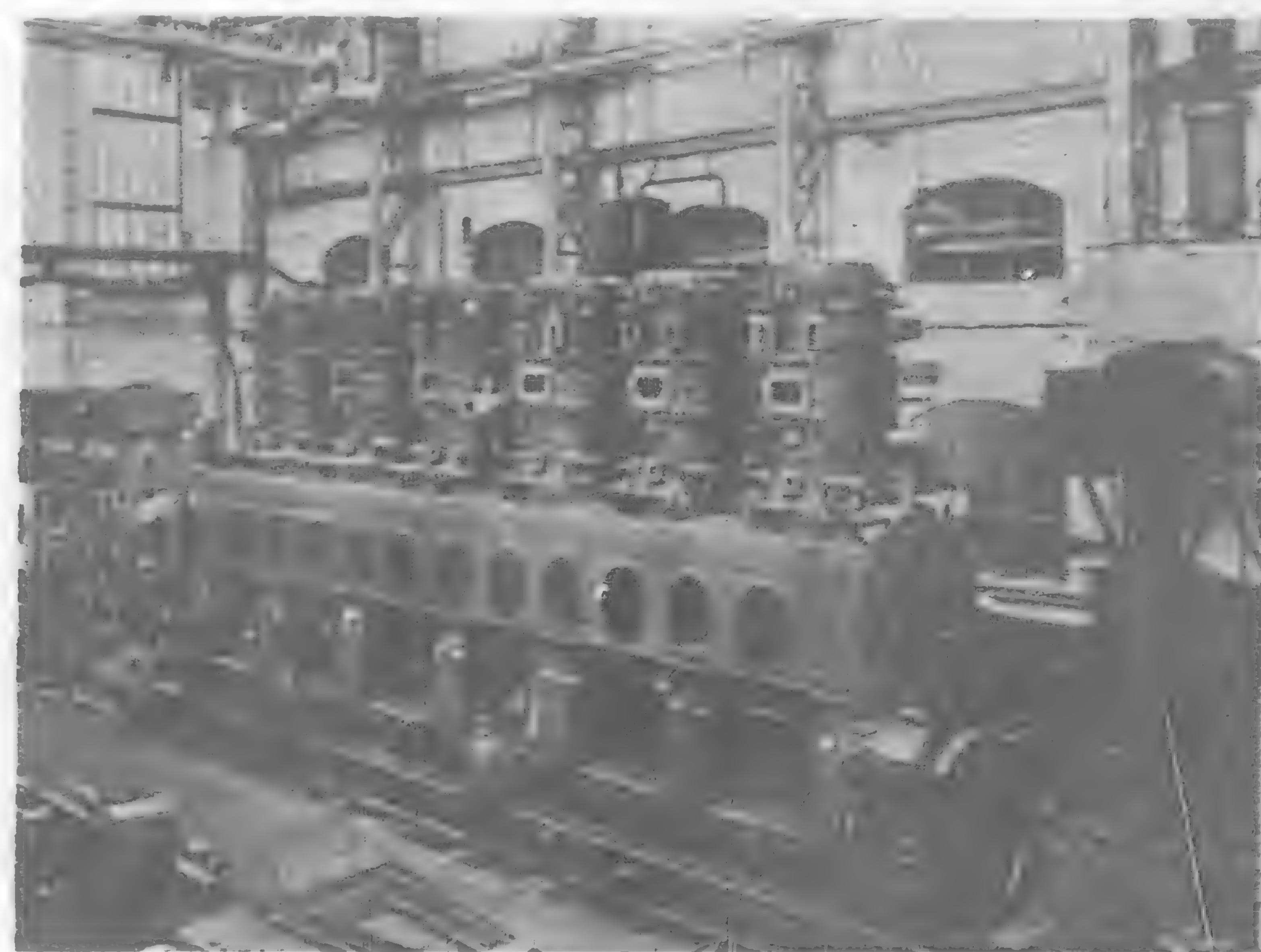
Reversible, Single Acting, Four-Stroke Marine Diesel Engine of 360 b.h.p. With 9 Cylinders, 115 r.p.m. with Airless Fuel Injection for Spanish Liner, "Cabo San Antonio" (1929)



Single Acting, Four-Stroke Diesel Engine with Airless Fuel Injection and Trunk Pistons, 8 Cylinders, 2,100 b.h.p., 187 r.p.m.



Reversible Single Acting, Four-Stroke Marine Diesel Engine of 900 b.h.p., 6 Cylinders, 215 r.p.m. for Tug, "Haniel XXVIII" (1923)



First Reversible, Double Acting Two-Stroke, Diesel Engine of 12,000 b.h.p., 6 Cylinders, 160 r.p.m. Built 1912-17 by M.A.N.—Nuernberg for German Battleship, "Prinzregent Luitpold" Maximum Overload Capacity 3,000 b.h.p. per Cylinder

type of the four-cycle trunk engine without cross-head had been constructed and marketed successfully, causing several licensees—the total amounted to 27 firms)—to start the construction of Diesel engines once more in various countries.

The reduction of the fuel consumption to 185 grams=0.408 lbs. per b.h.p./hr. increased the sale of Diesel engines including four engines of 400 b.h.p. each in 1902, for a tramway power station in Russia, which was going to become the biggest consumer of Diesel engines. At the beginning of 1906, the import duty on gas oil was reduced in Germany with the result, that many new orders for Diesel engines were placed in this country.

In 1907/08 the original Diesel patents expired, resulting in unlimited competition of Diesel engines of many types for all purposes imaginable. The shipping world introduced Diesel engines—especially two stroke engines were temporarily in front—for the propulsion of sea-going ships. Danish and Swiss firms—not handicapped in their activities by the World War—supplied the majority of low speed four-and two stroke Diesel engines for commercial vessels. When the World War broke out in 1914, the M.A.N. had to stop all efforts to join their foreign competitors in the development of these marine Diesel engines for commercial purposes. A valve-scavenged two stroke engine of 12,000 b.h.p. for a German battleship and more than 500 high-speed, four cycle engines totalling more than 500,000 b.h.p. for German submarines were supplied by the M.A.N. for the German Navy, the largest sets being of 3,030 b.h.p. each.

After the war strenuous efforts were made by the M.A.N. to develop high-powered Diesel engines for marine-and stationary purposes and especially to construct on a large scale standard Diesel engines of small and medium output of the single acting four stroke type with airless fuel injection. Engines totalling hundreds of thousand of b.h.p. were the result.

The climax of efficiency regarding the development of the Diesel engine, is the high-powered double acting two-stroke engine. A very effective port scavenging system, created by the M.A.N., is the backbone of the research work which produced the M.A.N. type of these high powered internal combustion engines for marine-and stationary purposes. A long list of engines with hundreds of thousands of b.h.p. have been successfully supplied in keen competition with many

types of single acting two-stroke and single-and double acting four-stroke engines of other makes. For large units of more than 10,000 b.h.p. per set, the superiority of the double acting two stroke type is unrivalled and generally acknowledged by the fact, that this system has now been adopted by practically all Diesel engine makers of the world.

Problems of the present time and the near future include :

- 1.—the construction of Diesel engines for heavy and low grade fuel oils like boiler fuel oil, coal-tar oil (creosote oil) powdered coal, etc., if possible, with airless fuel injection,
- 2.—the development of the high-speed Diesel engine for the propulsion of land, water-and air craft,
- 3.—the further development of methods of super-charging and utilization of the exhaust gases of Diesel engines for the recuperation of waste heat as well as of mechanical energy for driving super-charging-and scavenging machinery, etc.

#### Appendix I.—Summary of Some Figures and Facts

1893-1897 : Preliminary researches and efforts of Dr. Diesel and the M.A.N.-Augsburg to create the Diesel engine.  
 1900 : The "Grand-Prix" granted to the M.A.N.-Augsburg for a Diesel engine shown at the World Exhibition in Paris.  
 1903 : The first marine Diesel engine of 140 b.h.p. (4 cylinders of 280 mm. bore and 300 mm. stroke) and 400 r.p.m. ordered by the German Admiralty; the weight is 69 kg./b.h.p., the fuel consumption amounts to 191 gr. b.h.p./hr. A second engine designed with reversing gear; maximum speed obtained : 550 r.p.m.=5.5. m./sec.

1905 : Four sets of four cylinder Diesel engines of 230/280 b.h.p., speed 375/400 r.p.m. ordered by the French Admiralty (weight 10.5 tons=35 kg. / b. h. p.) for the submarines *Circe* and *Calypso* 58 hours non-stop run of 600 miles made by the boat under warlike conditions.

1908 : The first direct reversible six cylinder Diesel engine of 850 b.h.p., speed 450 r.p.m. ordered by the German Admiralty; bore 400 mm., stroke 400 mm., weight 21.3 tons=25 kg./b.h.p.

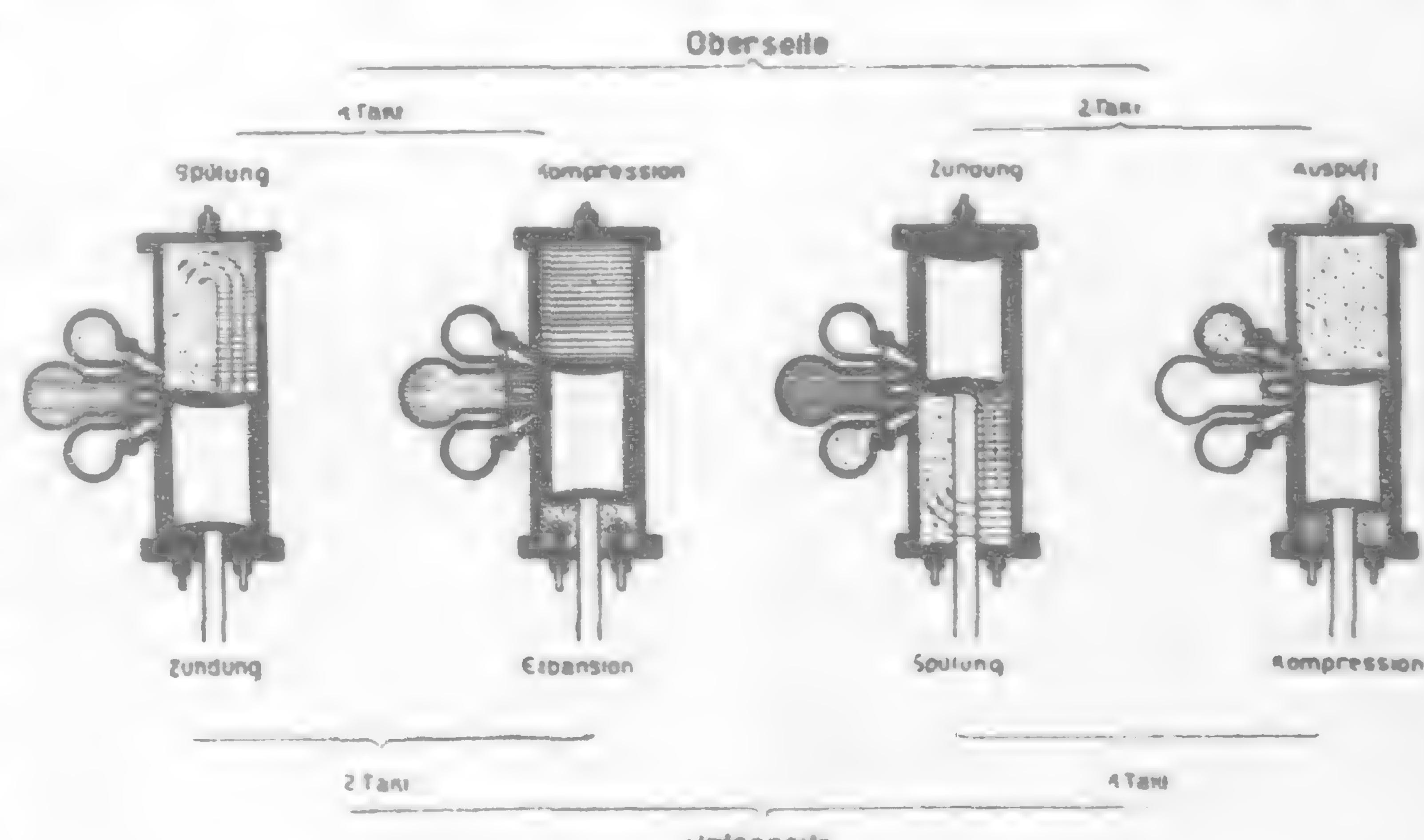
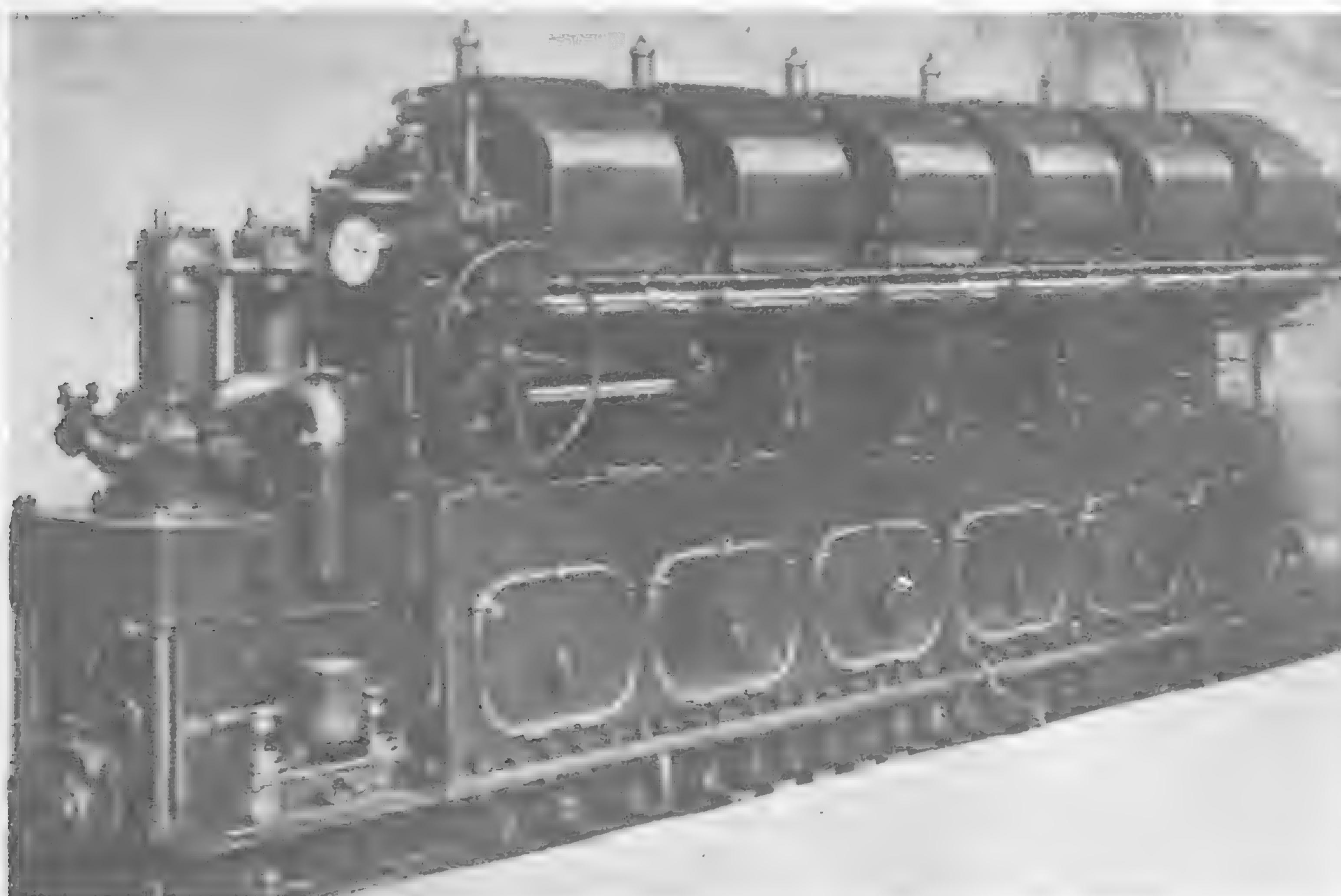


Diagram Scheme of the M.A.N. Port Scavenging System



First German Submarine Diesel Engine of 850-1,000 b.h.p. (1908-09)



Double Acting, Two Stroke, 10 Cylinder Diesel Engine with Airless Fuel Injection 11,700 b.h.p., 215 r.p.m., Two Sets Supplied for Peak Load Purposes to Substation of Hennigsdorf near Berlin

1910: Successful six days trial run of this engine with a maximum load of 980 b.h.p.

Eight Diesel engines of the same type ordered for four German submarines, later 24 sets of 1,000 b.h.p. each (bore 410 mm., stroke 420 mm.) ordered for 12 larger German submarines.

The first single acting two stroke Diesel engines of 300 b.h.p., 500 r.p.m., of the valve-scavenging system, constructed by M.A.N.-Nuernberg; many engines of different sizes supplied for marine purposes to several countries. Since 1908 research work started in Nuernberg for the development of the double-acting two stroke system. The climax of these efforts was a six cylinder engine of 12,000 b.h.p., speed 160 r.p.m., cylinder bore 850 mm., stroke 1,050 mm. for a German battleship.

1908-1913: horizontal double acting four stroke engines with 1,000 b.h.p. maximum output per cylinder built in Augsburg.

1914-1918: reversible high-speed Diesel engines of the single-acting four stroke type developing 250, 300, 550, 1,200, 1,750 and 3,030 b.h.p. each supplied for the German Admiralty (submarines), totalling 558,500 b.h.p.; furthermore many similar sets for auxiliary purposes of large warships and for the propulsion of boats, launches, etc., supplied.

1919: medium size and small Diesel engines with airless fuel injection developed on a large scale for stationary and

marine purposes (100—3,000 b.h.p. per set with 3-8 cylinders, weight 60-90 kg./b.h.p.).

1925: Research work started in Augsburg to develop the M.A.N. port scavenging system for single-and double acting two stroke Diesel engines. Largest set of 15,000 b.h.p. with nine cylinders, speed 94 r.p.m. Other installations of this type include two sets of 12,000 b.h.p. each with 10 cylinders, speed 215 r.p.m., weight 25 kg./b.h.p.

Largest marine installations of this type: Four engines of 7,000 b.h.p. each on the Italian m.s. *Augustus* 33,000 gross reg. tons.

Four engines of 18,000 b.h.p. total capacity on the French m.s. *Lafayette*.

Four engines of 12,600 and 12,000 b.h.p. on the German liners *St. Louis* and *Milwaukee*.

1930: 126 marine double acting M.A.N. two stroke engines supplied, with a total output of 450,000 b.h.p. for 61 ships, total production more than 600,000 b.h.p. in five years.

1931: under construction in Augsburg a 50,000 b.h.p. installation for a German battleship, weight only 8 kg./b.h.p.

1924-1925: high speed Diesel engines of the single acting four stroke type developed for lorries, railcars, boats, tractors, etc.; weight 10-15 kg./b.h.p. Diesel locomotives built for electro-mechanical and pneumatic power transmission; max. output 1,200 b.h.p. per set.

## Pacific Meeting of American Foreign Traders Invites Far East Spokesmen

ESTERN Asia is the one section of the world where our volume of export trade has gained ground rather than lost during the depression, declared the National Foreign Trade Council in announcing the plans for its convention in Honolulu on May 4, 5 and 6 next. The volume of our exports to Japan, China and India, the Council points out, is more than 6 per cent greater for 1931 than for 1930, in contrast to the fact that the volume of American export trade, as a whole diminished by more than 20 per cent during this same period.

The outstanding case of our increased trade in the Orient is that with China, where we sold products worth \$98,000,000 last year compared with sales of \$90,000,000 the year before, the only important gain made during 1931 in our export commerce, which raises China from tenth to seventh position among the purchasers of American products.

The program of the Honolulu convention has recognized the westward tendency of our trade by inviting spokesmen from Japan, China, Australia, New Zealand and the Philippines to address sessions particularly devoted to these divisions of the Pacific area. The Council believes that the present critical situation in the Far East has added a new significance in time and occasion to the frank interchange of views on the vital commercial questions affecting the Pacific area on which the Honolulu program will be based.

A convention ship will take delegates from Los Angeles to Honolulu and this ship, the Matson liner *Malolo*, will return the delegates to San Francisco in time for the annual meeting of the Chamber of Commerce of the United States during the week of May 15. Boat trains are being operated in connection with the convention ship from New York and Chicago with connections for delegates from the West Coast states. The schedule makes it possible for delegates to travel from New York to Honolulu in less than eight days. By special permission of the Interstate Commerce Commission summer rates on the railroads are applied to both these conventions, and steamship accommodations are 20 per cent below the current rates.

The Honolulu Chamber of Commerce has made extensive plans for the delegates' entertainment and a "Pageant of the Pacific," depicting the growth of the Pacific area to commanding importance to the world commerce, will be held at the time of the foreign trade meeting.

The Council has received a telegram from Riley H. Allen, Editor of the *Honolulu Star Bulletin* and chairman of the local convention committee, stating that tourist travel to Honolulu is in its usual volume and that practically all the hotel reservations that were cancelled at the beginning of the year have been reinstated.

# Nippon Denryoku Kabushiki Kaisha Builds 70,000 kw. Steam Station\*

Metropolitan-Vickers Electrical Company Supply Turbo Generating Sets; Babcock & Wilcox Boilers Installed

By SEISAKU ODAJIMA, M.I.E.E., Japan and GEORGE SCOTT, M.I.Mech.E.

THE Nippon Electric Power Co., Ltd. (Nippon Denryoku Kabushiki Kaisha), popularly known as the youngest of the five principal power companies of Japan, recently completed the second of its steam standby stations. At present the installed generating capacity of this company is approximately 443,000 kw. Of this amount, 210,000 kw. is steam plant. There are two steam stations, one at Amagasaki of 140,000 kw. capacity, and one at Tsurumi of 70,000 kw. capacity. After completion of the development, the aggregate generating capacity will be approximately 800,000 kw.

The Company's 154,000-volt main transmission line inter-connects the City of Tokyo with the City of Osaka. The general scheme of generation and transmission will be gathered from the map. It will be seen that many water power developments in the area of Toyama on the Japan Sea side of the island and the Masuda River developments are linked by high tension transmission to Osaka which is a 60-cycle area, and also to Tokyo which is a 50-cycle area, the total length of transmission being 400 miles.

The principal means of generation is water power, there are two seasons yearly during which there is a water shortage, to supplement the service during these dry seasons and to provide against any interruptions of the water power plant, steam power stations have been erected at Amagasaki (Osaka) and at Tsurumi (Yokohama), these being the terminal points of the transmission line. Both plants are on the seashore where a good supply of condensing water is available and are situated conveniently for coal supplies from Kyushu which are transported by sea.

The site for this station is between Yokohama and Tokyo on a large tract of reclaimed land in Tokyo Bay. The total area of reclaimed land is approximately two square miles. The reclaimed area consists chiefly of sand pumped up from the sea bottom. The depth of this being about 30 feet above original level. The total area of the power station site is 540,000 square feet. Of this, the

power station occupies 216,000 square feet, and the coal storage occupies 324,000 square feet. Owing to the loose sandy nature of this land, very special precautions had to be taken to secure a foundation suitable for the buildings and machinery.

An initial excavation of about 17 feet below general ground level was made, and the whole area of the station was piled to a depth varying from 60 to 75 feet below this excavated level into a firm gravel layer about 10 feet thick which was found to exist about 85 feet below general ground level. On the top of the piles, a mat  $6\frac{1}{2}$  feet deep of reinforced concrete was constructed. This mat

constitutes the foundation for the building and the machines, and together with the side walls of the building and piling makes floating box-like structure. This is further strengthened by the heavy reinforced concrete culverts used for the circulating water system. The whole foundation structure can be clearly gathered from the illustrations.

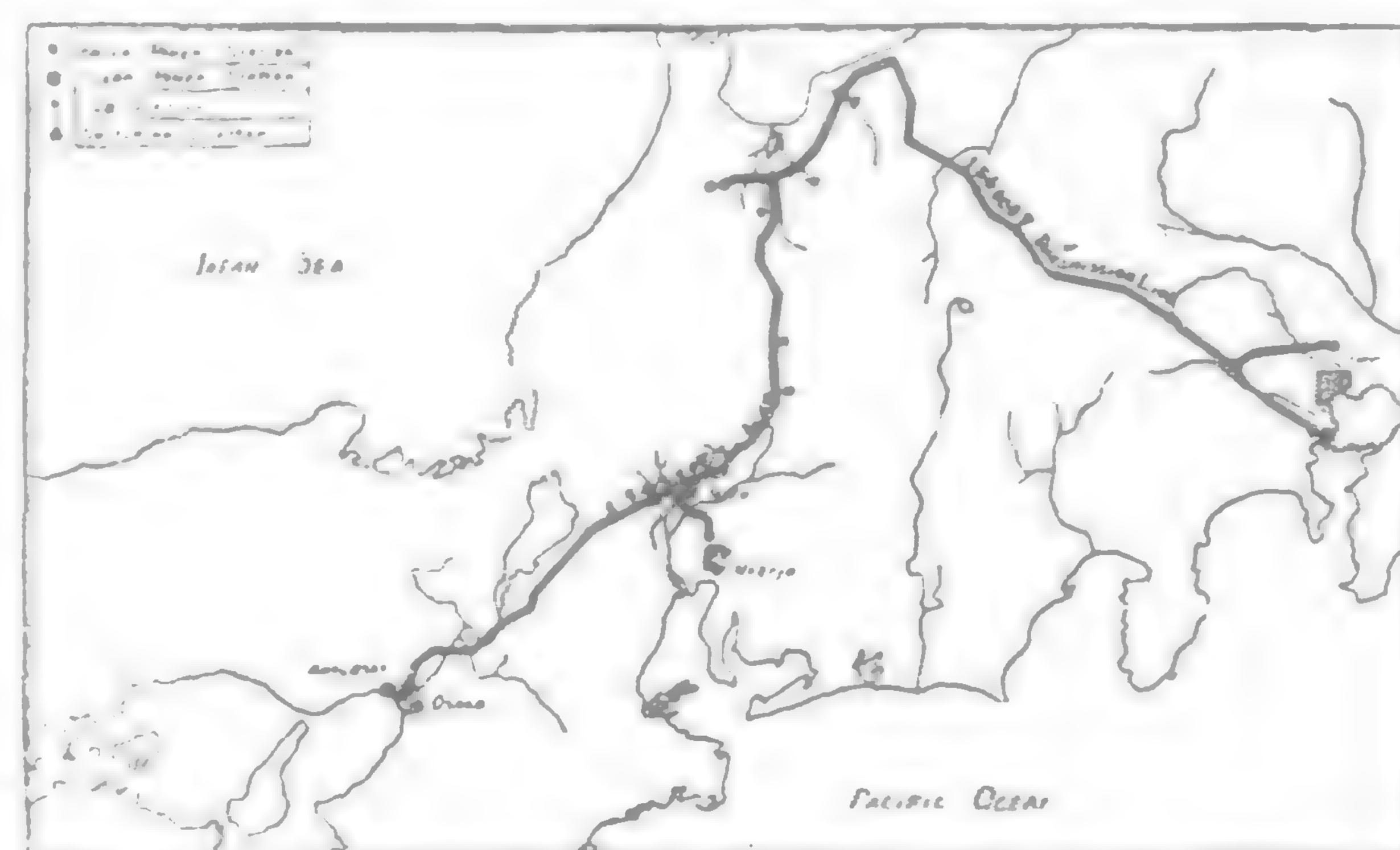
It will be observed that an endeavor has been made to obtain a structure that will float and move as a whole. During the construction and erection of the plant, careful observations were made, and these reveal a maximum movement of 0.3 inch and minimum of 0.1 inch.

## Boiler Equipment

The Company's policy of using boilers of large capacity has been adopted in this station. For the two generating sets of 35,000 kw. plus one house set of 5,000 kw., three boilers are used and one is installed as spare. The boilers were manufactured by Messrs. Babcock & Wilcox of England.

They are designed with sufficient capacity so that in emergency each one can supply one 35,000 kw. unit. During government tests and before the boilers and piping were completely covered with

\*The Metropolitan-Vickers Gazette.



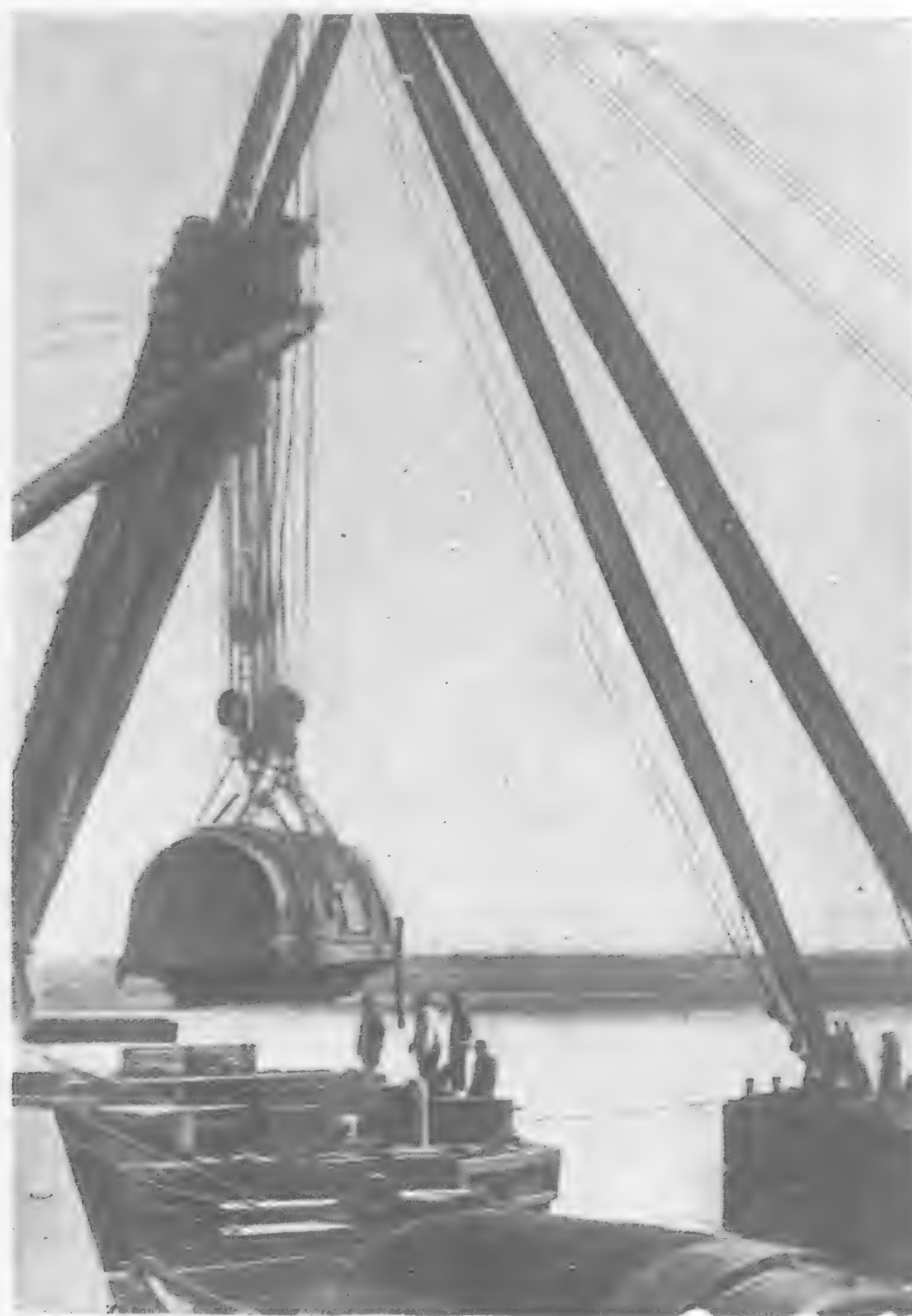
Map Showing 154,000-volt Transmission



Completion of the Piling



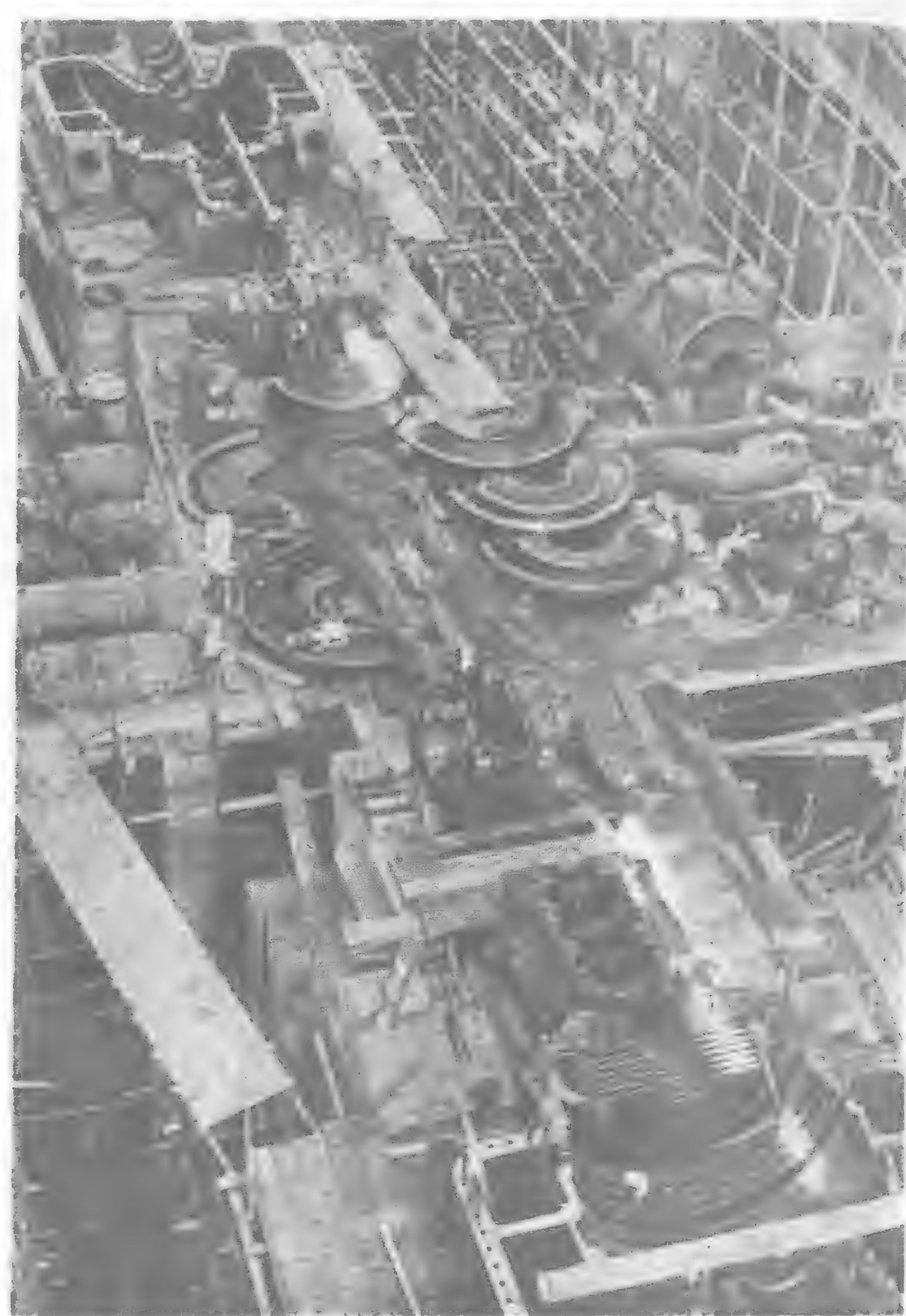
General View Foundations Above Ground



Transhipping Alternator Stators for Tsurumi Power Station, Tokyo

lagging material, a load of 26,000 kw. was carried quite easily by one boiler. The construction of the boilers will be gathered from the sectional elevation through the station. They are of the horizontal water tube type and the steam pressure in the drum is 425 lbs. per square inch, the maximum continuous evaporation being 300,000 lbs. per hour. To increase evaporation, a special drum was adopted four feet longer than the standard type. The number of sections of which there are forty-five was limited only by the length between the columns of the building. Each section consists of upper and lower portions, and the superheater is located between these. The upper portion has nine tubes, the lower portion five, and three return tubes. The diameter of water tubes is four inches and their length is twenty-four feet, making a total heating surface of 18,000 square feet.

One of the disadvantages of horizontal type of boiler is in the arrangement of baffles. The first proposals contemplated a tube length of twenty feet with two pass baffles, but after further consideration, twenty-four feet tubes and three pass baffles were adopted, this change simplified the construction of the combustion chamber at a slight sacrifice of air temperature at the outlet of the air pre-heater, the heating area of the economizer being unchanged.



Erection of Machinery and Building Proceeding Simultaneously

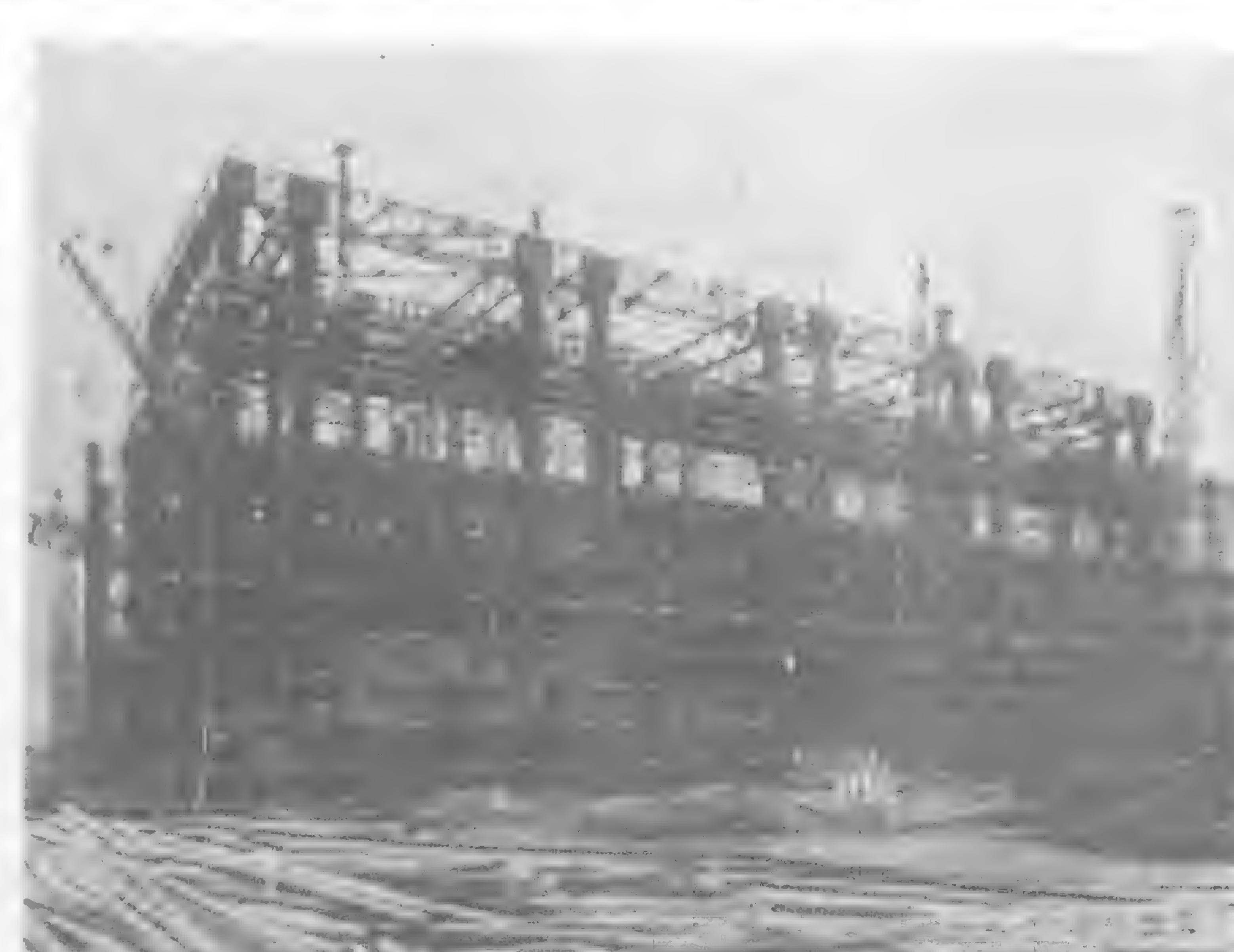
The super-heater has a heating surface of 5,700 square feet comprised of 2 inch diameter tubes of ordinary steel and the steam flow is two pass, and is superheated to 300° F.

The economizer has a heating surface of 7,780 square feet consisting of 2 inch diameter straight tubes, 26 feet long, made of ordinary steel. The straight tubes are connected at one end by U tubes and at the other are connected to headers. The air pre-heater is of the tubular type, with a heating surface of 40,000 square feet, with tubes 2½ inches diameter and 28 feet long. It is designed for a maximum outlet air temperature of 400° F.

A soot hopper is located between the economizer and the air pre-heater, it is of very large area designed to reduce the velocity and change the direction of the gases; this results in very efficient discharge of soot and fine ash.

#### Combustion Equipment


The pulverizing coal system was adopted after a full consideration of the problem. Of the two well-known systems, namely, the central bin system and the unit system, the latter was adopted. The unit system permits of the use of a number of units for very large boilers; this facilitates better adjustment of the firing and greater reliability of the whole steam. The unit system is much



General View of Steel Construction

## The New Tsurumi

## Power Station, Tokyo

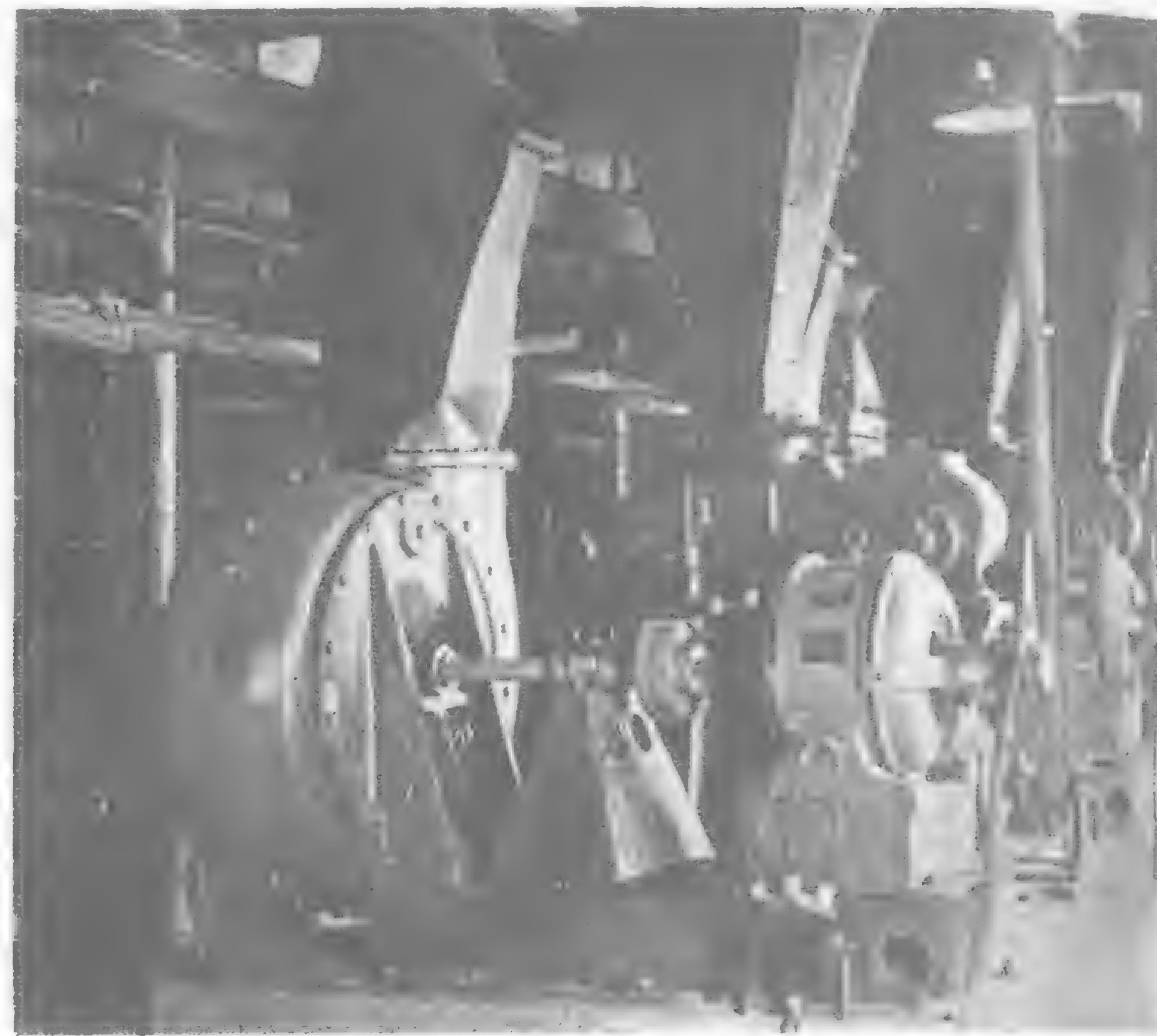


Sectional Elevation of the Tsurumi Generating Station showing one of the boilers and combustion chambers in section.

(48278)



Front View of Burners and Ignition Ports



Exhausters and Feeders

cleaner and more simple than the central system, and with the unit system there is no need to store large quantities of coal. This station being primarily a standby station, the load fluctuations are very sudden and severe, and occasionally it is necessary to cease operations entirely, quite suddenly. With the central bin system, this load fluctuation would necessitate carrying a large store of powdered fuel, with the possibility of spontaneous combustion occurring. The unit system entirely precludes this difficulty.

There are three pulverizing mills for each boiler, and six burners. The capacity of each mill is 13,600 lbs. per hour for coal having 13 per cent moisture content. The actual coal used has a 10 per cent maximum, the average being 7 per cent to 8 per cent, and to avoid troubles of operation with a higher moisture content, care is taken to reduce the moisture content of the coal to 7 per cent or 8 per cent.

The coal is dried by using heated air. The drying process takes place during grinding, the air temperature in the pulverizing mill outlet being adjusted to about 160° F., this temperature being considered the maximum useable if distillation of coal tar in the feed pipes is to be avoided. The minimum load for the boiler is 60,000 lbs. per hour, and one mill and burner can evaporate 20,000 lbs. per hour.

Bailey walls are used in the combustion chamber. The cubic capacity being approximately 17,000 cubic feet. The effective heating area is 3,000 square feet. The rate of combustion per cubic foot per hour is 25,000 British thermal units. The bottom of the furnace is fitted with ash hoppers.

Forced draught and induced draught are both employed for each boiler. The capacity of the forced draught fan is 97,500 cubic feet per minute, driven by 225 h.p. induction motor, the speed variation of the motor being 50 per cent. The capacity of the induced draught

fan is 185,000 cubic feet per minute, this fan being driven by two motors, one being 250 h.p. and the other 700 h.p., the motors are arranged for speed variation of 70 per cent.

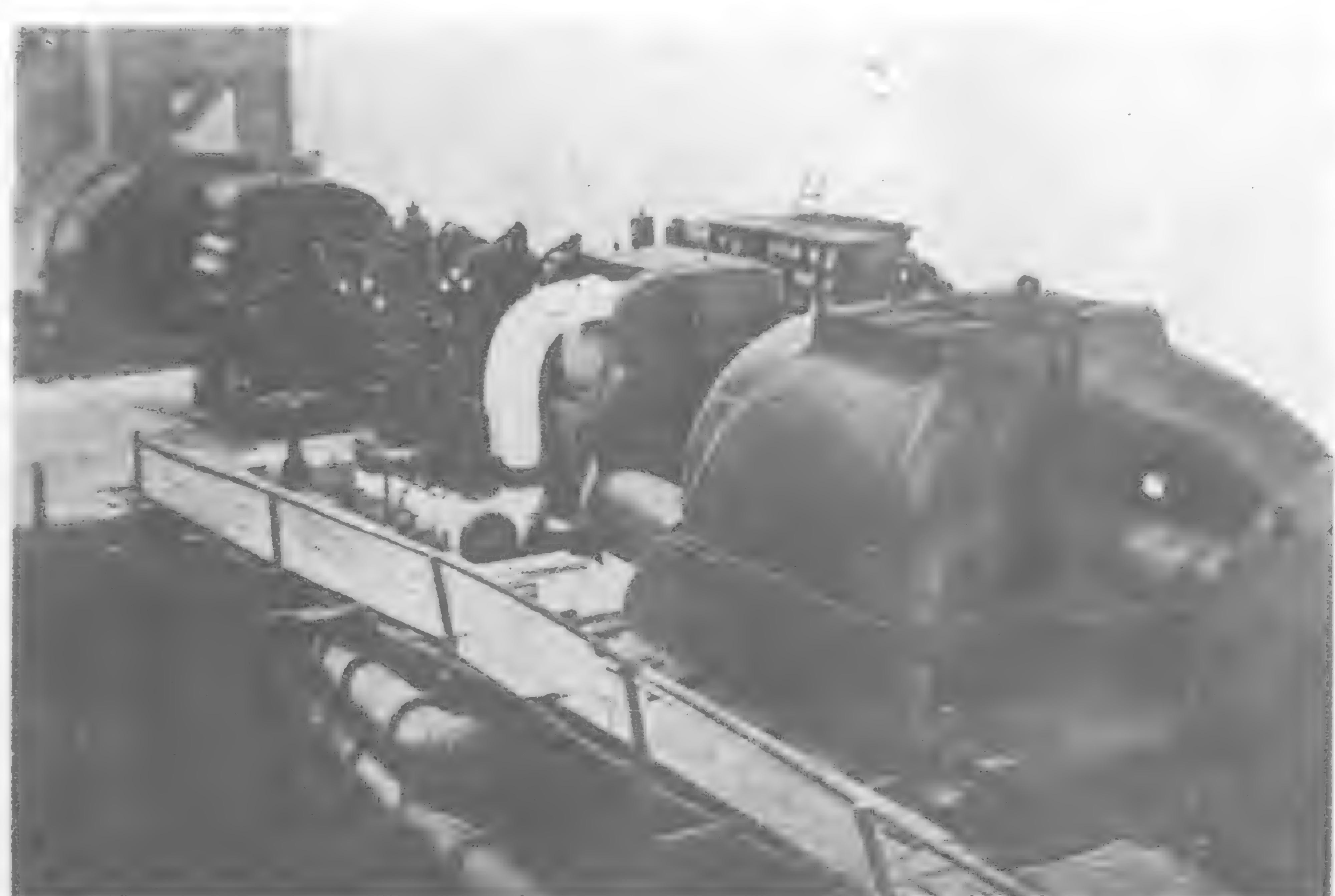
The height of the chimney above roof is 60 feet and above ground level 150 feet; the diameter is 15 feet, one chimney being used for two boilers.

### Engine Room Equipment

The engine room equipment comprising two main turbo generating sets was supplied by Messrs. Metropolitan-Vickers Electrical Co., and manufactured at their Trafford Park Works in England. Each set is of 35,000 kw. maximum continuous rating, and runs at 1,500 r.p.m., the steam conditions at the turbine stop valve being 350 lbs. per square inch gauge, the total temperature 700° F., and the vacuum at maximum load 28.5 inches. The materials constituting the turbine are such that an additional rise of 50° F. in temperature can be carried without injury. The critical speed is 30 per cent above the normal running speed.

The turbines are of the two-cylinder type consisting of a high pressure and a low pressure cylinder arranged in tandem. The high pressure cylinder contains one velocity stage followed by

twelve low velocity stages, built on small mean diameters, making it possible to use low steam velocities and thus ensure a very high blading efficiency. The peripheral speed of the discs is very low and the factor of safety is correspondingly high. The high pressure cylinder is completely made of steel and the diaphragms are of special mild steel. The low pressure cylinder is fitted with seven velocity stages followed by five rateau stages and two multi-exhaust stages. These multi-exhaust stages are of the Baumann patent type which enable the diameter of the low pressure blading to be



One of the Generating Sets, Erection Almost Completed

# SKELETON DIAGRAM FOR THE TOKYO STEAM POWER STATION

## RAINGENERATOR.

43750 K-V-R.

35000 KW at 80% PF

5000 11000 V

# HOUSE GENERATOR.

8750 K.F.A.

6000 rpm at 30% PE

7000 K.W. at 60 H

5000 33000

## IRON TRANSFORMER.

43750 K.T.A. 39.

U<sup>K7</sup>/22-69-16-63-60<sup>KD</sup> A-

## HOUSE TRANSFORMER.

1000 K.P.A. 34

2000 N.W. 41. 67

72-69-66/33 KV




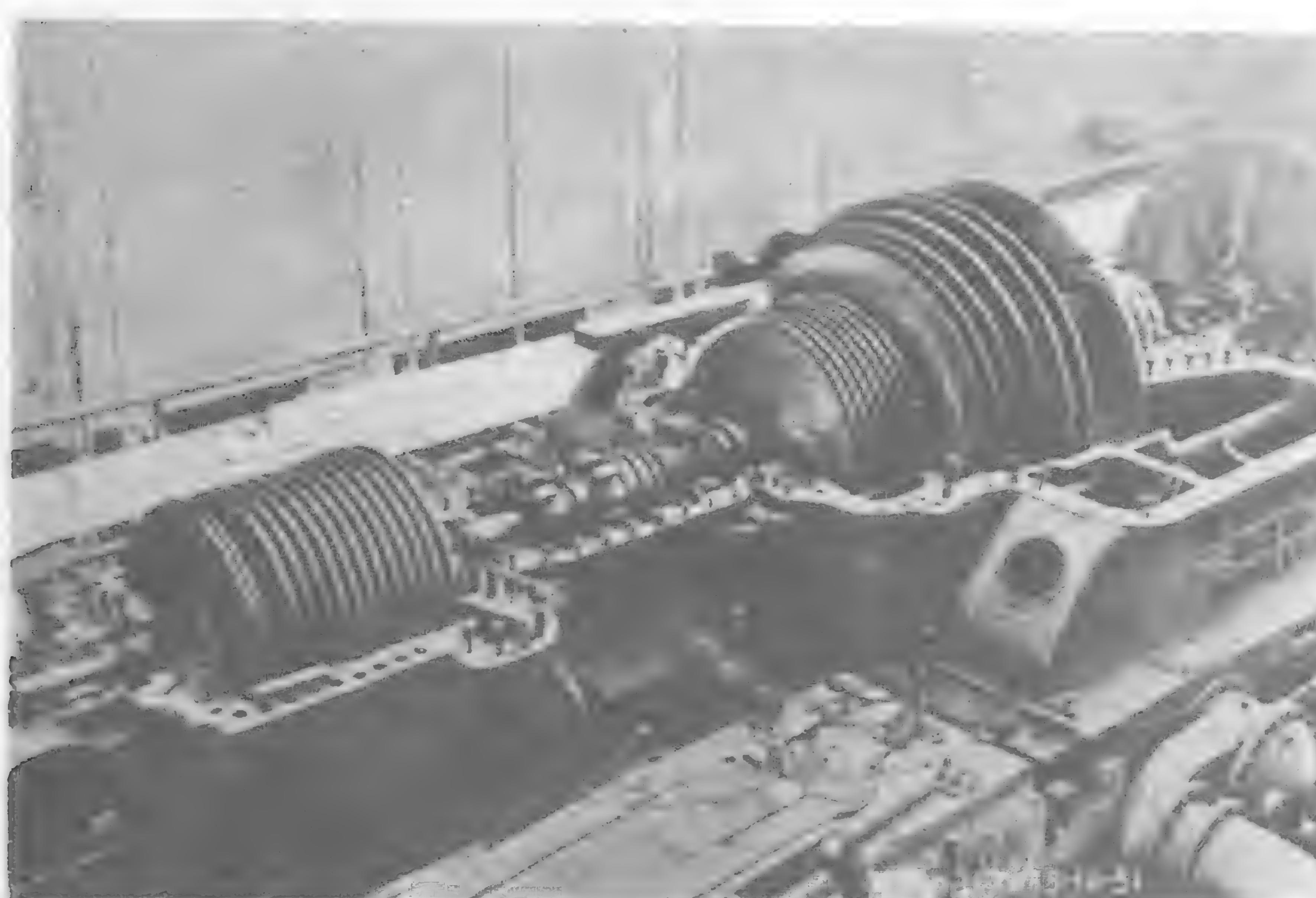
Fig. 12—Skeleton diagram of the electrical circuits

small, even though the volume of steam to be dealt with is very large indeed.

The alternators have a capacity of 35,000 kw. (43,750 kva.) maximum continuous rating, 11,000-volts, 3-phase, 50-cycle, and are excited by special radial faced commutator excitors at 300-volts. The alternators are ventilated by means of centrifugal fans mounted on the ends of the rotor and a further supply of cooled air is circulated by means of a separately motor driven fan. The ventilating air is cooled in a closed circuit air cooler, a volume of 80,000 cubic feet of air per minute being circulated through the ventilating and cooling system. The ventilating system is fitted with alarm signals and red glow lamps to indicate when excessive temperature occurs. The alternators are also arranged to be suitable for use as a synchronous condensers for power factor correction of the main transmission line, and when operating for this purpose will give approximately 90 per cent of their full load kva. with a leading power factor, and 75 per cent full load kva. with a lagging power factor.

### The Surface Condensing Plant

The Surface Condensing Plant is of the Metropolitan-Vickers Patent central flow type. The shell is arranged to form a large volute round the tubes, ensuring high tube efficiency combined with low resistance to passage of steam and incondensable gases. The condenser is bolted to the turbine exhaust flange and spring supported on the foundation blocks. Air and incondensable gases are withdrawn from the center of the condenser by means of steam operated air ejectors, the ejectors being arranged as part of the feed water heating system so that the heat in the steam after performing work in the ejectors is regained in the feed water. The surface condensers are designed for a duty of 330,000 lbs. of steam per hour, vacuum 28.5 inch, when supplied with 52,740 gallons per minute of circulating water at 70° F. The cooling surface is 43,000 square feet. The extraction pumps, circulating water pumps and air ejectors are arranged in duplicate. The circulating water pumps are driven by two 440 h.p. motors at 485 r.p.m. Extraction pumps are driven by two 53 h.p. motors at 1,440 r.p.m.



Tandem Turbine Set in Course of Erection



General View Station and Coal Wharf

### Feed Water Heating Equipment

Feed water heating is accomplished by passing the feed water through heaters in the following sequence. Air ejector heaters, integral feed water heater built into the main turbine, heater using spindle gland leakage and external heater. The feed water is raised to 214° F. in the external heater at 35,000 kw. load.

The boiler feed make-up is procured by evaporators arranged to take steam from the turbine tapping of the external heater, the evaporated water being condensed in the integral feed water heater. The evaporating equipment is capable of distilling about 15,000 lbs. of raw water per hour. A simplified diagram of the feed heating scheme is shown on this page.

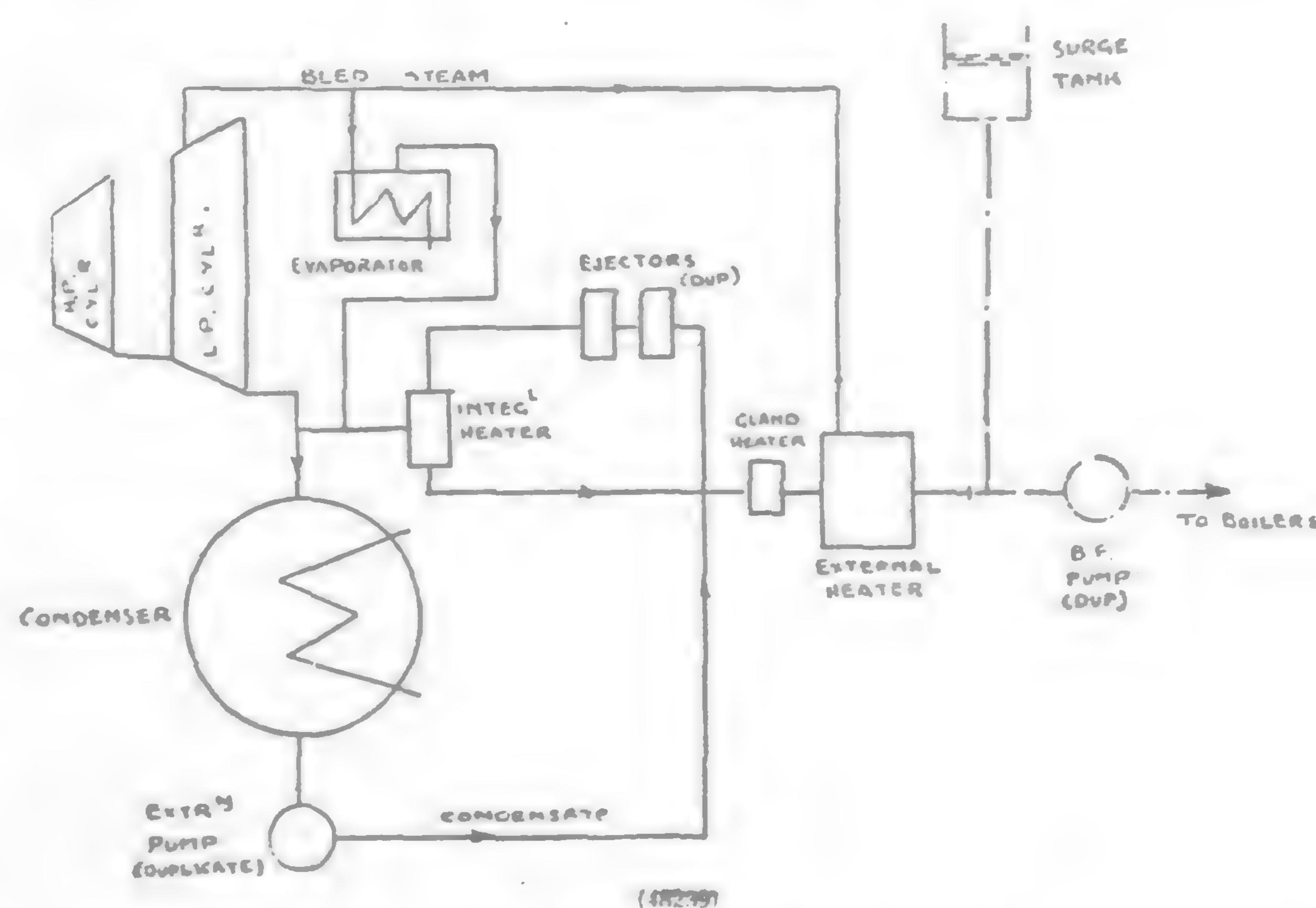


FIG. 9.—Diagram of the Feed-heating circuit.

### Oil Filtering Equipment

Oil filtering of the lubricating oil is accomplished in one system which is common to the two sets. It is arranged with a common storage tank with suitable pumps to deliver the filtered oil back to the turbine oil tank.

### Electrical Arrangement

The electrical layout is very simple, the transformers are three-phase, the main alternators and transformers are directly connected and the generator voltage is raised to 66,000-volts. Oil circuit-breakers are installed on the 66,000-volt side. A duplicate supply of current for auxiliary services is obtained by means of a small house transformer from the main 66,000-volt system. A single bus-bar system for 66,000-volts is arranged in the station. The complete electrical layout will be understood by reference to the diagram. The whole of the auxiliaries in the station are electrically driven.

### General

Foundations, buildings and coal conveying plant were sublet to general contractors. All other erection was undertaken by the Company under the supervision of the Company's engineering staff and the direction of Mr. Seisaku Odajima, who is responsible for the design

(Continued on page 181).

## Sulzer Refrigerating Plant is Installed in Cathay Mansions

THE residential hotel, Cathay Mansions, at Shanghai, has a frontage of 223-ft.; it is 88-ft. deep and comprises 13 stories with a roof garden on the top. On the 13th floor are store rooms, bedrooms for the employees and part of the Sulzer refrigerating plant. The refrigerating plant consists of two vertical Sulzer ammonia compressors, each rated at 126,000 B.Th.U. per hour, the condenser, regulating station, ice tank and ice stores.

On the 12th floor there are also store rooms and rooms for the employees, as well as the kitchen and bakery. In the kitchen there are several refrigerators. The cold rooms for meat and fish adjoin the kitchen.

On the 11th floor is the dining-room with a vestibule, and beside it the pantries, which are also provided with several refrigerators. The dining-room is large enough for 400 persons to take their meals at the same time.

On the 1st to the 10th floors are furnished apartments, of which there are 136 consisting of single rooms in one half of the building. Each room has a small annexe with bath, washhand-basin, etc. The other half of the building contains apartments with 2, 3 and 4 rooms, each with bathroom, etc. All rooms are fitted with electric light, the current being supplied from the Lokawei power station of the Compagnie Francaise de Tramways et d'Eclairage Electriques, in which the electric generators are driven by Sulzer Diesel engines.



Pumping Station showing Sulzer 10-Stage Highlift Centrifugal Pumps

On the ground floor are the offices, main hall and water supply plant. Shown in the illustration can be seen the Sulzer centrifugal pumps driven by B.B.C. motors for supplying cooling-water to the condenser of the refrigerating plant. One pump alone is sufficient for the work, the other serving as a standby. The three pumps in the background were supplied by another maker: two of them serve for supplying water to the building, whilst the third is a fire extinguishing pump. In the same room there is also a small lighting set, which can supply current in case of breakdown in the supply from outside. The boiler plant for the central heating and warm-water supply is installed in the basement.

Concerning the working of the refrigerating plant the manager of the hotel reports as follows:—

“ . . . The installation has given the utmost satisfaction, and on dismantling recently after running for one year, all parts of the compressors were found to be in excellent condition, . . . I cannot speak too highly of the sturdy construction and high class finish of your product, and the careful and efficient manner in which the entire plant was installed . . . ”

## Japan to Study Metals

Plans for the establishment in Tokyo of the Japanese Nickel Information Bureau, a part of a new development in the scientific and industrial relations of Japan and the United States, were outlined recently at a luncheon given in New York by the executive committee of the Japan Society at the India House, with James A. Rabbitt, former American commercial attaché in Japan, who is about to proceed to Tokyo as adviser of the bureau, as chief guest of honor.

The new bureau is to follow the lines of similar bureaus which are established

in America by the International Nickel Co., officers of which were present at the luncheon; and at London, Berlin, Paris, Brussels, Milan and Frankfort.

Alexander Tison, who presided, stated that the nickel information bureaus were of an educational character relating to the development of metallurgy.

The speakers were K. Horinouchi, Consul-General of Japan in New York; Dr. J. A. L. Waddell, consulting engineer in metallurgy, and Mr. Rabbitt.



Showing two Sulzer Compound Ammonia Compressors each Rated at 126,000 B.T.U. hour Type EDV100



The Cathay Mansions

# Jitsugetsutan Hydro-electric Project in Taiwan

Based on Report by U.S. Vice-Consul HAYWARD G. HILL, Taihoku, Japan

ROM time to time during the past 11 years the Jitsugetsutan hydroelectric development in the island of Taiwan (Formosa) has been the subject of discussion in various reports from Japan. The project now seems about to become a reality. Negotiations for a bond issue were successfully concluded in New York in June of this year, and construction contracts have been awarded to five Taiwan contractors and two contractors from Japan proper.

Briefly, the project calls for the construction of a 100,000-kilowatt hydroelectric plant, to be operated by the waters of Lake Jitsugetsutan. This lake, situated about the center of the island at an elevation of 2,400 feet, has a catchment area of approximately 6.55 square miles, and in the future will be fed by tapping the waters of the Dakusui-kei (Muddy Water River). Incidentally, Lake Jitsugetsutan is regarded as one of the most attractive and picturesque places in Taiwan, and its potential value as a resort will not be impaired by the completion of the hydroelectric project.

The plant will be the largest in the Far East, and the current to be generated will be used to supply the needs of all Taiwan. When demand warrants, another plant will be erected below the site of the present project; to it will be conducted the water utilized by the first unit. The rest of the work to be done on the initial development is expected to require about three years.

Although the original plans were for the project to be a Government undertaking, it was finally decided to make it a joint activity of Government and private interests. This led to the formation in 1919 of the Taiwan Electric Power Co., a limited liability company, the stock in which was acquired by both Government and private interests; it is, therefore, quasi-official in nature. Under these auspices work was commenced in 1919. In 1922 financial difficulties caused activity to be suspended, and in December, 1926, the scheme was reported as definitely abandoned.

Nevertheless, in 1928 well-known American consulting engineers were called in to make a report on the character of the work already done and on the general feasibility of the project. The report was entirely favorable, and they made a number of constructive recommendations relative to certain features of the plans. It has been reported that these recommendations were put into effect and that they will ultimately result in savings of more than Y.11,000,000 (about \$5,500,000).

Subsequent to this survey Japanese experts of note made similar investigations, which assured that certain conditions and stipulations imposed by the House of Peers as a prerequisite to the granting of a state guaranty for the loan would be fulfilled.

An extended period of negotiation for a foreign loan with which to continue the project was successfully concluded in New

York in the latter part of June, 1931, when \$22,800,000 was made available at 5.5 per cent.

## American Machinery Used—No Foreign Constructors

The greater part of the equipment and machinery for the hydroelectric plant has already been purchased and is being held in storage during the period of suspended construction. Most of it is of American manufacture.

Foreign interests, however, are not to be allowed to share in the construction work. Furthermore, there has been considerable agitation among the contractors of Taiwan for exclusion of contractors in Japan proper from the bidding. The Taiwan contractors claimed that the work done 10 years ago was entirely in their own hands and was done well; that the project is essentially a local enterprise; and that they are capable of finishing most, if not all, of the remaining construction. This attitude led to many conferences between the Taiwan Electric Power Co. and the Taiwan Government General, resulting in the power company calling for bids from a selected list of contractors. Bids for continuation of construction work were opened on September 17, 1931, and contracts totaling Y.7,428,000 (about \$3,710,000 at par of exchange) were awarded to five Taiwan and two Japanese firms. Taiwan contractors felt that they had made a very good showing in the bidding and were well pleased with the methods by which it was carried out. Many of the bids were very close, indicating keen competition.

## Economies in Construction

As a result of recent revisions in the plans, the settling pool for the waters of the Dakusui-kei will not be required; connecting channels are to be shortened; the proposed level to which the lake was to have been raised has been lowered. This revision of plans, coupled with cheaper wages and a fall in the prices of many construction materials, will effect substantial savings in the total cost of the project. The revised plans are now being prepared for publication by the Taiwan Electric Power Co.

The completion of the Jitsugetsutan hydroelectric project is expected to stimulate the entry into Taiwan of many new industries. It is reported by the local press that capitalists and industrial leaders of Japan are to be urged to invest their capital in Taiwan, and their aid will be solicited in the promotion of new industries that are dependent chiefly on electricity for power. A new era in the general development of Taiwan is believed to be close at hand.

## Hongkong's New Brewery

Hongkong's new brewery will begin operations on May 14 next. This interesting information has been imparted by Messrs. Leigh and Orange, the architects, who have been responsible for the designing of the buildings, work on which will begin in a few days.

At the same time, it is learned that the brewery and its accompanying ice-plant and machinery houses, are to cover an area of 62,800 square feet. It is situated at Shan Tseng Bay, on the Castle Peak Road, and promises to be the finest brewery of its description in the Far East.

Nothing has been spared to make it fully equipped with modern plant and machinery, while special care will be taken to maintain its productions at the same standard of quality during the summer heat as in the cooler winter months. To this end, a large part of the building is to be insulated with cork to guarantee a temperature of about 40 degrees Fahrenheit. This temperature will remain the same all the year round.

There are to be two main buildings—the brewery and accommodation for ice-plant and machinery. In addition a large amount of space is being reserved for future developments, while provision is also made for offices, etc. The brewery is to be a handsome structure of 60 feet in height, composed of concrete shell on pile foundations. The machinery and ice-plant houses will be single-storey buildings of a similar type, and they are to be fitted with every modern requirement for the production of high quality beverages.

It is estimated that the brewery will produce an annual boil of 5,000 hogsheads and among the various departments are the following: Fermenting and distilling house, Malt silo with capacity for 180 tons, decanting and bottling rooms, re-cooling plant, cooperage, and several other essential departments.

The cost is estimated to be approximately \$150,000, and when finished, the brewery, which is owned by the Hongkong Brewers and Distillers Ltd., will be in the position to produce beer of a quality to compare favorably with any of the imported brands.

# Hangchow-Kiangshan Railway

THE Hangchow-Kiangshan Railway, one of the few railway projects in China to start actual construction in recent years, is drawing to a close of the first stage of its progress.

This is the completion of its line to Lanchi, a distance of 201 kilometers (125 miles) from its starting point at Hangchow. Train service is now in operation to I-Wu (76 miles) and track laying is progressing at an average rate of one kilometer per day. This rate will be increased shortly and it is expected that service will be extended to Lanchi soon.

Grading for the entire line has been completed and, with the exception of a small amount of culvert work, all other details are ready for track laying. Conditions peculiar to the section through which the farther portion of the line is constructed, together with the present financial situation, have influenced both the design of the structures and the methods employed in erecting them.

During the past year, the rate of exchange, from silver to gold dollars, has remained at an average of about 4½: 1. This has made it imperative that local materials be used to the fullest extent possible. More often than otherwise, this has resulted in more permanent construction than was originally planned, mass concrete arches being employed instead of temporary timber trestles, and concrete pipe culverts instead of corrugated metal.

Four feet diameter concrete pipes were as large as could be conveniently handled with the equipment available. When a larger section was required, these were placed in multiple strings, up to four lines.

On account of the high cost of lumber for culvert forms, these were of standardized design so far as practicable, in order that the same forms might serve for a number of culverts. No reinforcing material was used, excepting in the larger sizes of pipe culverts, 36-in. and larger.

A few short-span deck girders were used, the masonry supports being prepared in advance of track laying and the girders brought up and placed by the track gangs. A few 20-ft. openings, designed for deck plate girders, have been crossed by the use of timber stringers, with knee braces. Where longer spans were required and it was not feasible to place the steel girders during the period of construction, intermediate concrete footings were placed in the stream bed and temporary intermediate timber bents were erected to carry wooden stringers. This proved more economical than the construction of pile trestles, both because of the difficulty of transporting pile driving equipment, and because rock frequently was reached at shallow depth.

Owing to a long-continued low river stage, and other causes, the delivery of cement for the completion of a few of the 12-ft. and 16-ft. arch culverts was delayed. In order that the arch rings might have the full time required for setting, without delaying track laying, an ingenious expedient was adopted by the engineer in charge of construction. Empty cement drums (which are of metal) were used as forms for the construction of concrete columns which rested on the culvert walls and were later partially imbedded in the concrete of the arch rings. Timber caps and stringers were placed on these columns, to carry the track until the arches were ready to receive the load of filling and track. This method, saves two or more weeks delay in track laying. All material, with the exception of the portion of concrete in the columns which extends above the arch ring, is available for other purposes.

Transportation of materials which were required in advance of track laying often was a major problem. Cement of local manufacture was purchased in Shanghai, brought by rail or water to Hangchow, and transferred to junks for hauling up the Chien Tang River, or by canal to nearby points. In the most extreme cases, the cement was taken by junks to Lanchi (over 100 miles), usually making a part of the trip under sail but always requiring man-power for a considerable portion of the trip. At the shoals and rapids, the men stood in the river, shoving and lifting the craft through the current, instead of pulling by two lines from the shore.

At Lanchi, the cargo was transferred to smaller junks for transporting up the Kin Wha River as far as the stage of water would permit. At this point, the last word in shallow-draft craft was available, a bamboo raft resembling a huge toboggan. These can

very nearly comply with Mark Twain's specification for a steam-boat for navigating the upper Missouri river, one that can "run on a good, heavy dew."

From the bamboo rafts, the cement was transferred to wheel-barrows for an overland trip, on roads which were designed only for pedestrian travel. Cement purchased in Shanghai for M\$7.10 might easily cost nearly M\$11.00 on the job. Considering the difficulties of transportation, even this cost does not appear excessive.

The construction of a railway in China presents some difficulties not common in other countries. We have all read of the troubles encountered by the early lines, in getting through or past the many graves scattered over the country. *A modus operandi* has now been developed which greatly simplifies this though it still is something of a problem. The walled cities also present a special difficulty. In the interior, there is not only a local sentiment against making a breach in such a wall but it may yet serve a useful purpose in defending against bandit raids. Also, the walled-in areas usually (though not always) are completely filled with solid blocks of buildings, separated by narrow, paved streets. A right of way through such an area would be most difficult to obtain.

In most cases, the railway is located as close to the city wall as practicable though in the first two cases reached by this line, a small breach was made at the corner of each of the walls, under an agreement with the local authorities. There is a mystery surrounding the disappearance of some of the immense stone blocks with which these walls were faced though in some of the railway bridge abutments and culvert head-walls may be found some exceptionally massive masonry which does not bear any evidence of having come recently from the quarry. The city wall of Chuki, which dates back at least to the time that Columbus was promoting his great development scheme, rests on the talus of a prehistoric mountain slide. In cutting through this material, to a depth of eighteen feet, a vitrified drain tile, obviously in their original position, were exposed by the grading gang.

## Future Plans

Location surveys and detailed estimates have been completed for the second section, which is to extend to Yushan, a total distance from Hangchow of 230 miles. This will reach the head-waters of the river system of Kiangsi Province. Construction on this section will be started as soon as the line is completed to Lanchi. Nearly the entire northern half of Kiangsi Province can be reached by boats which navigate up to Yushan.

## Character of Line

The line is designed strictly as a "Light Railway," excepting that all permanent waterway structures are capable of carrying heavy traffic and, so far as practicable, other features are designed for a later revision, without waste, to conform to Chinese Government Railway standards. The favorable nature of the country traversed has made it possible, with little effect on the cost, to adhere to a limit of six degree (metric) curves and one per cent grades, the latter compensated for curvature.

From purely financial reasons, 35 lb. rail was used. All temporary track structures were designed to the limit imposed by this light section of rail, the axle loads assumed for designing being seven tons for cars and 8.6 tons for locomotives.

The same standards of construction will be adhered to in the extension to Yushan. About 70% of this extension will be a valley line, the remaining portion, from Kiangshan to Yushan, passing over the mountain range which forms the boundary between Chekiang and Kiangsi Provinces. An unusually favorable, low saddle affords an easy passage through this range, with light work and little curvature.

## Method of Financing

Owing to the unfortunate conditions in China for the past several years, few new projects have been attempted, and a still more limited number have reached the point of actual construction.

(Continued on page 181)

# Skip Haulage Plant at Fushun with Three-Phase Drive\*

By G. ERENYI

*In recent years, three-phase drives have been frequently employed for important haulage plant. This article contains a description of a large three-phase haulage plant and points out the particular factors which have to be studied with a three-phase system.*

**T**HE Fushun Colliery, which is operated and owned by the South Manchurian Railway Company is the most important coal mine in eastern Asia. The favorable coal occurrence enables the mineral to be partly exploited from open-cast workings. The enormous output and the vastness of the mine rendered electrification imperative.

The putting into service in the summer of 1931 of a new haulage plant that is entirely electrically operated, signified an important step towards the complete electrification of the mine. The plant is conspicuous for its unusual dimensions, its elaborated yet uniform layout and various technical innovations, whilst in respect of the electrical equipment affords particular interest inasmuch as the main winders are operated by three-phase drive, despite the size of the plant.

The enormous pit of the open-cast workings is circular shaped and is excavated step-wise. The height of each step i.e. bank, is about 33-ft. When the new plant was installed, the depth of the lowest bank from the surface of the pit was about 360-ft. For the present, the new electrified equipment is to exploit from four and then from six banks. When this depth is attained the equipment will be advanced to excavate from the ultimate depth of about 750-ft. The material is, for the most part, dug by excavators and loaded into trains, each comprising 13 wagons (each wagon has a loading capacity of about four tons). The yield is 70% good coal, 20% inferior coal and 10% shale, so that when designing the plant it was necessary to devise means for separating the yield at each point of excavation. The trains convey the material to the loading bridges erected on each bank, whence the material is transported by skips to the surface. The skip roadway is inclined at an angle of 18° so that in the initial stages of exploitation (360-ft.) the length of the haulage track amounts to about 1,200-ft., the ultimate length being about 2,640-ft. The four banks of the first workings are shown in cross-section in Fig. 1, whilst Fig. 2 depicts the longitudinal section of a loading bridge. Each of these bridges has three hoppers, one for shale, inferior and good coal, respectively. The train loads are emptied into the hoppers by means of a tippler into which the wagons can be pushed without needing to be uncoupled. Conveniently operated flaps permit the material to be filled into any of the three hoppers, whence it is emptied into the skips. Figs. 1 and 2 show the skips under the hoppers. The hoppers are so constructed that the material can be emptied into both of the skips belonging to each winder (see Fig. 2).

Two hundred and eight tons of material are dealt with per hour on each loading bridge, the short time of 12 minutes being available for discharging a train-load, which is solely rendered possible by fully electrical operation of all components. The tippler, the wagon pusher, the slides and flaps of the hoppers are furnished with electric drives and contractor gear, being remotely controlled by the two operators stationed on each bridge. It is beyond the scope of this article to discuss the details of the controlling equipment and the signalling plant which effects communication between the loading bridges and the plant at the surface of the pit. The picture on this page depicts a view of the workings, showing trains on the bridges and two skips which are in motion. The terraces of the mine may be seen in the background of the picture.

A double drum winder is determined for two loading bridges; therefore two winders are required initially and three ultimately. The overground discharging station is illustrated in Figs. 3 and 4.

It comprises a rail track, inclined at an angle of 18°, the hopper equipment below the bank-level and the rope sheaves with pithead frame. The skips comprise an underframe and a tiltable wagon-body which on the discharging side possesses a trap that is hinged on a shaft so as to swing open. The wagon-body is tipped by means of tilting rails located on the bank-level and empties its contents during the travel into the hoppers. Fig. 3 shows the skip tilted into its limit position. The bunker is divided up into three hoppers in this case too, and the material is distributed by opening and closing traps in the discharge chute. The good coal is conveyed by means of belt conveyors from the under-



View of Open-Cast of the Fushun Colliery, South Manchuria, Operated by the South Manchurian Railway Showing Underground Loading Bridge with Hoppers for Loading the Skips

ground hoppers to the coal preparation plant while the shale and inferior coal is discharged direct into railway trucks. The flaps, feeding shoes and belt conveyors are throughout electrically actuated.

In the Fushun Colliery, the electrical energy is generated in a steam power station at 10 kv, 60 cycles. The haulage motors are supplied at 6 kv and the motors for the auxiliary drives at 220 v. Transformer stations are provided in the machine house and underground for transforming from 10 kv to 6 kv and down to 220 v. The underground transformer station (10 kv to 220 v) is visible in Fig. 1 between the second and third loading bridges. A total transformer capacity of 3,500 kva is installed which will be increased ultimately to about 5,000 kva. About 40 motors are

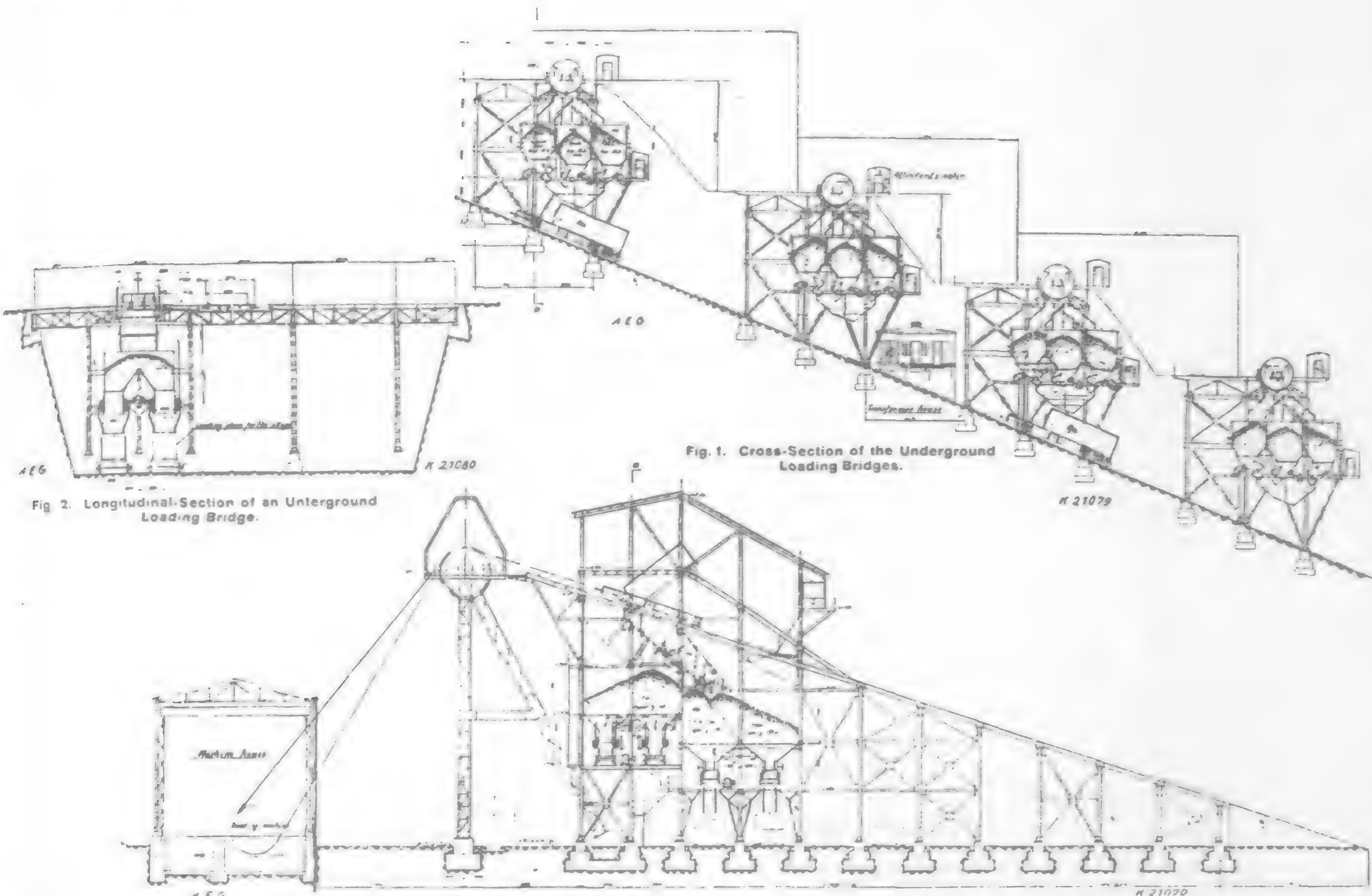


Fig. 3.—Cross-Section of Overground Hoppers (see Fig. 4)

installed for the auxiliary drives at the pit head and underground. Following this brief outline of the entire plant, it is proposed to deal somewhat fully with the winding engines.

For mining, D.C. drives in Ward-Leonard connection are usually employed for the main winders, this preference being amply warranted by the many technical advantages linked with this method. However, the circumstance that the supply available is almost invariably three-phase and so requires expensive motor-generators for converting the current into direct current, frequently prevents the employment of a D.C. drive. In the last few years, every effort has been made to improve the three-phase drive in its application to haulage plant, and therefore when considering all modern aspects, no serious objection can now be levelled against the employment of three-phase current for even the largest plants. The inclined haulage plants for Fushun could be equipped by three-phase drives without difficulty, inasmuch as they are exclusively determined for transporting material, and operation at different speeds does not arise.

Fig. 5 shows the interior of the machine house with the first two winders. The machines are designed for the following duty :

Useful load of a skip	...	...	28 tons
Weight of a skip	...	...	30 "
Angle of inclination of the track	...	...	18°
Maximum winding speed	...	...	20-ft./sec.
Double drum winding without tail rope.			
Length of the haulage road when			
winders were put into service	...	1,200-ft.	
Length of haulage road ultimately	...	2,640-ft.	
Diameter of the rope	...	...	2-in.
Weight of the rope	...	...	7-lb./ft.
Diameter of the winding drum	...	...	16-ft. 7-in.
Width of the winding drum	...	...	5-ft. 2-in.
Speed of the winding drum	...	...	22.9 r.p.m.
Speed of the winding motor (synchronous)			257 r.p.m.
Ratio of the single-step reduction gearing			1 : 10.45
Output of the winding motor	...	...	1,300 h.p.
Hourly haulage capacity of a winder			
with two skips	...	...	446 tons

As previously mentioned,  $2 \times 208 = 416$  tons of material are tipped on the two bridges, i.e. the plant has a reserve to meet heavy duty. The width of the drum is sufficient to take 1,500-ft. of rope in one layer. The remaining 1,150-ft. are wound on in a second layer. It was impossible to make the drum so wide that the entire rope could be wound on in one layer, as the angle of deflection of the rope would have become inadmissibly large.

It was impracticable to couple the drum direct with the driving motor in view of the low speed of the drum. Spur gearing is generally unavoidable with three-phase drives and it is this circumstance that has hitherto obstructed the progress of such drives, for it was considered that spur gearing reduced the operating reliability and occasioned great noise. It is, moreover, self-evident that particular care and the best-quality materials are required in the construction of reduction gearing with a ratio exceeding 1 : 10 between a pair of spur wheels driving a drum of 6-ft. 2-in. diameter and subjected to the sudden loads accompanying haulage duty. However, the experience derived from numerous gears delivered proves that the modern technique of manufacture is in every way capable of accomplishing this task satisfactorily. The gears have forced oil lubrication and helical toothed and run perfectly silent. Therefore any doubt as to the advisability of employing high-class reduction gears is unwarranted, especially in the case of single-step gears.

As the mining work progresses, the loading bridges will be moved lower down in the pit and so will necessitate altering the relative position of both drums of each winder. For this reason one of the drums is provided with an adjusting arrangement. As adjustment of the drums is seldom required in the present case, recourse was had to the simple and dependable adjusting arrangement by way of bolts. The special construction of the hub of the drum as necessary for adjustment by bolts may be seen in Fig. 5. A motor-operated spurwheel adjustment can be employed where such manœuvres have to be carried out frequently.

The output of the driving motor is prescribed by the winding diagram. The mean square root power of the motor as calculated from this diagram amounts to 1,300 h.p., the maximum power peak being about 2,400 h.p. This value is undoubtedly small considering the colossal yield of the mine, and the dimensions of

the motor are surprisingly small in relation to the winding machine (see Fig. 5). This is to be ascribed to the comparatively small angle of inclination— $18^\circ$ —of the track.

Mechanically, the motor is particularly robustly constructed commensurate with the arduous duties inseparable from winding operations, whilst electrically, it is designed as a normal three-phase slip-ring motor with continuously rated brushes. The motor is protected by a high-tension panel with an oil circuit-breaker and with the usual apparatus and instruments. The breaker is closed during operation and only trips in the event of some irregularity. Starting, stopping and reversing of the motor is accomplished by h.t. reversing contractor gear which is electro-magnetically operated. The control drum of the contractor gear is positioned on the liquid startor, which, as customary, is connected with the slip-rings of the motor. The manœuvring capacity and dependability of the entire winding plant largely depends upon the pertinent construction of this startor. The AEG has designed a liquid startor specially for winding plants. With this starting gear, the electrodes which immerse in the liquid resistance are stationary and the liquid is continually circulated by means of a motor-driven centrifugal pump (see Fig. 6). Regulation is effected by a built-in circular slide which can be adjusted from outside by a rotatable shaft via suitable gearing. The shaft and the corresponding toothed segment may be seen at the bottom of the illustration. Adjustment of the slide alters the size of the surface of the electrode in contact with the liquid, so altering the speed of the motor. The operating shaft of the startor is coupled through a chain drive with the controller of the stator contactor gear, and the main shaft is connected by rod gear with the control lever located on the driver's platform.



Fig. 4.—Overground Discharging Station before Putting into Service



Fig. 5.—Interior of the Engine Room

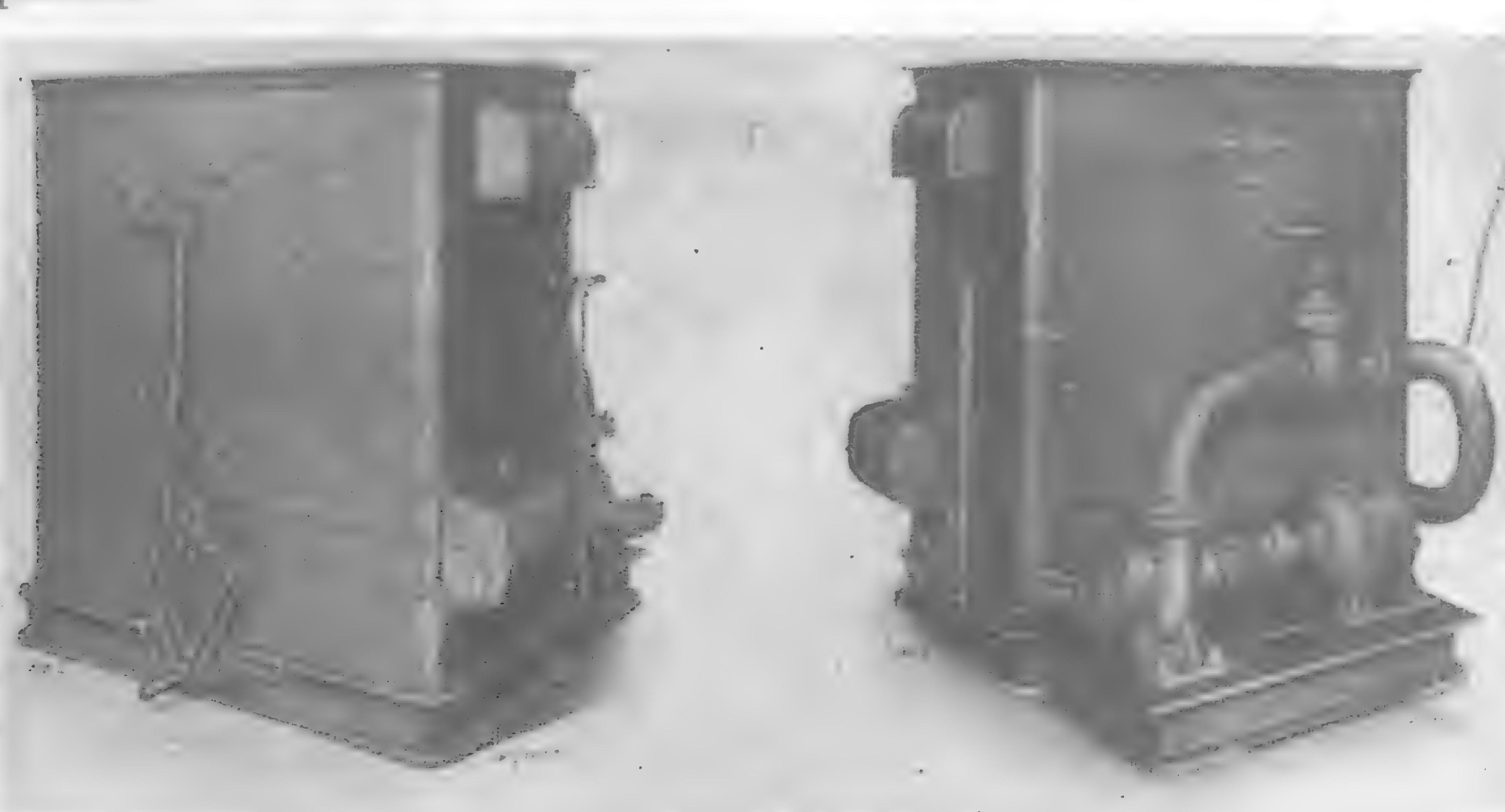


Fig. 6.—Liquid Startor

The stator contactors are switched out when the control lever is in mid-position and the electrodes are only slightly immersed. The motor runs clockwise or anti-clockwise according to whether the lever is moved forwards or backwards, whilst the resistance in the rotor circuit is reduced as the lever is moved to the limit position so that the motor runs up to its normal speed. The driver's platform equipped with the control lever is to be seen in Fig. 5. Two other levers, the manœuvring brake and the safety brake lever are also fitted. Both levers are connected with the compressed air braking equipment which, in addition to the liquid startor, is also of para-

mount importance for proper operation. The equipment is the [fruition of many years of developmental work, and in its modern patented design constitutes an equipment of superior characteristics and workmanship. The equipment has been already described in this journal\*).

In front of the driver's platform (see Fig. 5) may be seen the brake lifting magnet belonging to the brake, the other apparatus—recording tachograph, depth indicator and safety apparatus—being mounted between the brake magnet and the winding drum. Space does not allow a description to be given of the mutual functioning of these apparatus or of the elaborate safety and controlling equipment installed; however the protective devices for supervising the speed will be briefly reviewed.

Course control of the speed is effected by the centrifugal switch mounted on the motor shaft. If the synchronous speed exceeds 10% to 15%, the contacts of the centrifugal switch open and the main switch is disconnected; the brake magnet which thus become de-energized falls, the safety brake acts and shuts down the plant. In the case of important plants, it is, moreover, endeavored to control the speed during the entire trip, including the accelerating and retarding periods. With a D.C. winding motor in Ward-Leonard connection this can be accomplished simply and safely, for with this arrangement every position of the control lever corresponds to a certain speed. In order to adhere accurately to the prescribed winding diagram, the depth indicator is furnished with a cam wheel which is driven by the latter and shows the pertaining speeds at the various depths. The movement of the cam wheel is transmitted to the driver's platform so that the stroke of the control lever is limited. Hence the lever cannot be intentionally adjusted to a higher speed than is prescribed for the corresponding position of the haulage track.

With the three-phase motor on the contrary, the speed is not clearly defined by the position of the lever—which in this case actuates the liquid startor—for it may differ with one and the same rotor resistance, depending upon the load. Cam wheels are fitted on the depth indicator in this case also, but only limit the speed at full-load. Reverse current braking must be adopted when lowering loads, whereby the speed is particularly liable to attain an excessive value. With three-phase drives therefore, an auxiliary safety apparatus is employed to ensure accurate speed control. This apparatus is connected with the main shaft of the winder and at each point of the haulage track compares the actual speed with that prescribed, through the agency of a centrifugal governor. Should the prescribed speed be exceeded at any point of the track, or when starting and shutting down, the apparatus trips the oil breaker of the motor and the safety brake engages.

With winders which are also determined for men winding and work at higher speeds than 13-ft./sec., the safety apparatus is extended to form a trip governor. This apparatus does not shut down the winder when the speed is exceeded, but re-establishes the prescribed speed automatically by actuating the manœuvring brake. The maximum degree of safety is attained with this apparatus. A safety apparatus was entirely adequate for the winding plant at Fushun as only material is wound.

The underground loading bridges and the overground hopper plant as well as rope sheaves were designed and supplied by the Bamag-Meguin A.-G., Berlin-Cologne-Bayenthal. The mechanical equipment of the winders was supplied by the Linke-Hoffmann-Buschwerke, Breslau. The entire electrical equipment for the pit-head and underground was supplied by the AEG.

## Hangchow-Kiangshan Railway

(Continued from page 177)

While Chekiang Province has suffered less from political disturbances, floods, and other troubles than almost any other section, it has suffered indirectly with the rest of the country. It has been only through the foresight, energy and resourcefulness of former Governor Chang Chin-kiang that the line has been made possible. As much of the Provincial revenues as could be spared were devoted to the construction of this railway and the credit of the Province was pledged to local banks for the small loan found necessary for its completion. Governor Chang, who is now Chairman of the National Construction Commission, is one of the "elder statesmen" of China, was a member of the original revolutionary group which supported Dr. Sun Yat-sen, and is still active in National affairs.

The project is administered as a strictly Provincial venture, through the Construction Division of the Province. The present Commissioner of Construction, Mr. Y. F. Tseng, served for three years as Vice-Chairman of the National Construction Commission and has undertaken to complete this railway through to Yushan as one of the major projects of his Department for the coming year.

### Operation

The first section of the line to be completed, 32 kilom. in length, was placed in operation on June 1, 1931, the service being extended gradually as the track was completed.

This progressive extension of service has given an excellent opportunity for observing the effect of additional length on the revenue derived per unit of length.

This shows an average daily revenue of M\$1.39 per kilometer during the 27 days that service extended only to Chien Shan (32 kilom.), with a step by step increase to a daily average of M\$10.19 with service to I-Wu (128 kilom.)

As was fully expected, the initial revenue has consisted almost entirely of that derived from ticket sales, the development of freight business in this country necessarily running parallel with a gradual evolution of the economic changes which take place in the territory served. The only exception to this is the case of a railway which passes through an area already served by canal or river transportation. Only a small portion of the section reached by the Hangchow-Kiangshan Railway has been so served, and that most inadequately. For this reason, agricultural production has been confined principally to materials required for home consumption and those few items which, owing to their nature and value, could warrant an excessive transportation charge, frequently amounting to as much as M\$0.50 per ton-kilometer. At the present rate of exchange, this would be equivalent to about G\$0.14 per short ton-mile and would yield to the laborer who carries the load on his shoulders from ten to twenty cents (gold) per day.

### Personnel

From its inception in 1928, the project has been under the direct charge of Mr. C. Y. Tu, Managing Director and Engineer-in-Chief; with Messrs. Y. Y. Liu as Associate Director; C. Y. Hou, Bridge Engineer; Easin Mao, Mechanical Engineer; and M. I. Wu and Y. W. Pao, Division Engineers in charge of construction. The organization is 100% Chinese, excepting in the matter of education, the Commissioner, Managing Director, Associate Director and two of the Department heads being graduates of Western universities, all but one of which were American institutions.

## Nippon Denryoku Kabushiki Kaisha Builds 70,000 kw. Steam Station

(Continued from page 174).

and layout. The completion of foundations, building work, erection of machinery, boilers, etc., occupied about sixteen months. The material used for the building and other structures included 3,000 tons of steel and steel structures, 100,000 meters of electrical cables, 42,000 barrels of cement. The skilled labor employed by contractors was 90,000 man-days, and by the Company 75,000 man-days, and laborers 60,000 man-days, making a total of 225,000 man-days. The maximum number of people employed during one day being 20 staff, 212 skilled workers and 483 laborers.

The total cost of the station including land, wharf, buildings, was Y.10,200,000. The cost of buildings, Y.810,000. Cost of foundations, Y.400,000. Cost of land, Y.530,000.

### "The Chemist's Paradise"

Manchuria is "the industrial chemist's paradise," Professor Ralph H. McKee, of the Department of Chemistry, Columbia University, learns from Mr. Fawn S. Louie, one of his former students. Applying American ideas of efficiency to manufacture at Mukden, Louie, a native Chinese, is doing what the native population regards as "miraculous things" in reclaiming waste products. Steel, enamel, and color, which were imported from Japan for the manufacture of enamel wash basins, are now obtained from local sources, and the scrap steel from stamping out the basins is reclaimed to make soup spoons, cups and other small articles. Copper oxide for coloring the enamels is now made from copper shavings gathered from various brass work shops and from the Government arsenal. The cost of this copper oxide is thirty cents per lb. whereas the Japanese product costs ninety-five cents. Human labor has replaced the machine in some instances because it is not only cheaper, but provides employment, and "keeps the men out of banditry." Women and young girls are employed to inscribe Chinese characters and artistic designs on the enamel wares, and men have been substituted for mechanical jaw crushers. In fashioning by-products, hand-operated machines, a recent innovation, are used to press small articles from waste sheet steel.—*The Chemical Age*.

# Soviet Iron and Steel Program for 1932\*

THE 1932 program for pig-iron production in the U.S.S.R. has been set at nine million metric tons. This compares with about five million tons produced last year.

The increase this year is to be effected in two ways. Firstly, all efforts will be made to increase the utilization of existing blast furnaces and to obtain an additional two million tons of pig-iron from them. The remaining two to three million tons are to be produced by the 26 new blast furnaces which are scheduled to begin partial operations during the year. Two of these furnaces have been working since January, one at Magnitogorsk, in the Urals, the other at the Kadievsk plant in the Donets Basin.

The capital investments in the iron and steel industry in 1932 are planned to reach a total of 1.8 billion roubles (\$927 million). The bulk of this is to be spent on completing the additional blast furnaces scheduled to start operations this year. The production of the 26 new furnaces is estimated at 2,790,000 tons of pig-iron, while their total capacity will be 7,370,000 tons.

The Magnitokorsk mill will put six furnaces into operation with an annual capacity of 2,148,000 tons, while its production of pig-iron this year is expected to amount to 978,000 tons. The Kuznetz works will start four furnaces, with a capacity of 1,226,000 tons and an output of 600,000. The Mariupol mill will complete two furnaces, with a capacity of 608,000 tons, and will produce 87,000 tons. At other plants the capacity and the output in 1932 of the new furnaces will be as follows: Zaporozh'ye, 608,000 tons

capacity, 145,000 tons output; Krivoy Rog, 304,000 and 15,500 tons, respectively; Makayevka, 264,000 and 180,000 tons; Konstantinovka, 125,000 and 94,000 tons; Alchevsk, 608,000 and 87,000; Kadievsk, 85,000 and 83,000; Moscow Region mill, 242,000 and 142,000; Kamenskoye, 608,000 and 234,000; Kosogorsk, 240,000 and 130,000; and Lipetsk, 304,000 and 15,000 tons of pig-iron, respectively. All these plants are in the Ukraine except the Moscow Region mill, the Kosogorsk plant and the Lipetsk works.

Of these 26 furnaces, sixteen are in new plants and the remainder in older plants which are being enlarged and rebuilt. About 30 per cent of the pig-iron production scheduled for 1932 is to be produced by the new furnaces. The eight largest ones, of 358 tons capacity each, are in the Ural-Kuznetz area.

The development of steel production is also proceeding at a rapid rate and a number of open-hearth furnaces and rolling mills are being rushed to completion. This is expected to make it possible to increase the output from 5.35 million tons of steel in 1931 to 9.45 tons this year.

Production at the Cheliabinsk ferro-alloys plant has been improving steadily, both as to quantity and quality. While in August, 1931, only 99 tons of ferro-alloys were produced, in November production increased to 1,000 tons and in December to 1,140. The program for 1932 calls for an output of 14,000 tons of ferrosilicon, 2,000 of ferrochrome, and 600 of high-grade refined products.



Elevator of the Kosogorsk Steel Mill

\*Economic Review of Soviet Union.

## Osaka Plans Road Building

The Osaka Prefectural Office is going to revive the plan for the construction and repair of the industrial highways connecting the important towns around Osaka, which was first made by Mr. Yuichiro Chikaraishi, ex-Governor of Osaka, when the Seiyukai Ministry was in power.

The original plan provided for an outlay of Y.22,970,000, and it was endorsed by the Osaka Prefectural Assembly and referred to the Government. Because of the no bond issue policy of the Minseito Ministry, however, the plan was withdrawn.

In view of the urgent need for the construction and the repair of roads for the development of the city of Osaka and its surrounding towns, Governor Shibata upon consulting officials of the public works section of the prefectural office has now drafted another plan for the construction and repair of the highways, extending for 371,575 meters. The cost required is Y.37,558,500, being larger than the original plan by Y.15,000,000. The work will take from 10 to 15 years for completion.

The plan was endorsed by the Road and Highway Commission of the prefectural office and the prefectural authorities intended to commence the work at the beginning of the fiscal year of 1932-33, being confident that the plan will be endorsed by the Government which is now inclined to favor bond issues to a certain extent according to the nature of the work to be undertaken.

According to the new plan, the highways to be constructed are of widths from  $5\frac{1}{2}$  to  $14\frac{1}{2}$  meters, mostly being wider than 10 meters, the sections being as follows:

Ikeda-Fukuzumi, Hirakata-Yao, Moriguchi-Tatsuta, Yao-Fujiidera, Nagano-Hirano, Sakai-Kokubu, Tondabayashi-Kashihara, Tondabayashi-Hashimoto, Nagano-Sakai, Nagano-Otora, Nagano-Otsu (Senpoku-gun), Otori-Sano, Kishiwada-Ushitaki, Sano-Mizuma, Hirakata-Kusuhamura, Osaka-Ikeda, Osaka-Sumimichimura, Sakai-Furuichi, Sakai-Otora, Ikeda-Kameoka, Higashinose-Fukuzumi, Ikeda-Hiedano, and Takatsuki-Ikami.

# World's Largest Compound Lever Testing Machine

**D**R. BRADFIELD, the chief engineer of the New South Wales Government, in drawing up his specification of the new Sydney Harbor Bridge, made provision for the construction of a testing machine of such power and internal accommodation that large sized models of the more important built up members of the bridge could be tested by direct experiment.

In doing this, the engineer had in mind the elimination of all possibility of error due to any miscalculations in the preparation of the designs and an added assurance that the undertaking would be rendered free from mishap either during its erection or throughout its ultimate service.

Messrs. W. & T. Avery Ltd., Soho Foundry, Birmingham, designed and constructed for the contractors, a testing machine of 1,250 tons capacity—the largest compound lever testing machine in the world of its kind. Models of all important units of the Sydney Bridge were made to a scale of 1/6th to 1/4th, dependent on the actual size, and these were individually tested in this machine. By this means the preliminary calculations were definitely verified in a practical manner, and local failures, especially of the riveted connections, were rendered almost impossible. As a direct result of this, the building of the bridge went forward without complications of any kind.

In addition, the Avery testing machine afforded much useful information regarding the design of some of the temporary erecting gear, especially in regard to the huge anchorage required to hold the unsupported sections of the arch as they were being erected.

As in all testing machines, the 1,250 tons machine comprises two separate systems, one for the application of the load to the specimen, and the other for recording the capacity of the load applied. In the 1,250 tons machine the load is applied by a hydraulic cylinder at the right end of the machine, while the load indications are registered by the weighing system at the opposite end. As weighing machine experts will appreciate, the part which required the greatest amount of thought in scheming out of the whole of the apparatus was the weighing system. To receive a load of 1,250 tons upon knife-edges was something which had not been done previously.

Finally, four levers were arranged in parallel, each having a load knife-edge 60 inches in length, the only problem now presenting itself being that of securing even distribution of the total load over each lever. This was obtained by forcing each knife-edge into hard contact with its respective bearing and then adjusting the knife-edges and bearings at the outer extremities of the lever to suit.



Compound Lever Testing Machine Built by Messrs. W. & T. Avery, Ltd.

The indication is that the future of testing apparatus will probably lie more in the direction of testing the complete unit of a structure, instead of testing only the material, which leaves to chance the possibility of error on the part of the constructor or designer.

## A FEW FACTS ABOUT THE LARGEST UNIVERSAL TESTING MACHINE IN THE WORLD.

Made by W. & T. Avery Ltd., Soho Foundry, Birmingham.	
Loading Capacity	1,250 tons.
Over-all Length	120 feet.
Weighing System	4 Levers working in parallel, each lever equipped with load and fulcrum knife-edges of hardened steel.
Steelyard	Reading from zero to 1,250 tons by one ton divisions.
Straining Apparatus	Cast Steel Hydraulic Cylinder and Ram, Maximum Pressure—2 tons per square inch.
Ram	32 inches diameter, 5 feet 6 inches stroke.
The machine will take and test to destruction a Built up Compression Member 50 feet long with a cross section 45 inches square.	
Testing in Tension Wire Rope and Chains	Round Bars up to 6 inches diameter, 50 feet long. Flats specimens up to 12 inches wide, 3 inches thick, 50 feet long.
Transverse Test	42 inches wide, span of 20 feet. Depth can be extended to 50 feet.

## Singapore's Water Supply

Singapore's latest water scheme, upon the completion of the work at Pontian Ketchil, will yield a daily supply to Singapore of about 40 million gallons. In 1923, when it was realized that the ever-increasing consumption demanded an augmentation of the supply, two catchment areas were acquired. The Gunong Pulai area was developed by building two dams, thus forming a lake with a capacity of 1,200,000,000 gallons. The Pontian Ketchil area was also developed by the construction of two dams, creating a lake of a capacity of 3,200,000,000 gallons.

At Gunong Pulai both waters were treated in aerating and sedimentation tanks for the removal of iron. After that it was filtered and flowed to Singapore in a steel pipe line about 33 miles long—to Fort Canning. Here the reservoir was a reinforced concrete covered reservoir containing 30,000,000 gallons, and in conjunction

with Pearl's Hill reservoir provided Singapore with approximately two days' supply—and thus, in case of trouble, repair work could be carried out without Singapore suffering. At the pumping house, three engines and pumps, the whole of the equipment is British, the pumps being supplied by Hathorn Davey & Co., of Leeds, and the engines by Messrs. Crossley & Co.

It is interesting to note that the floor and part of the walls and columns have been laid with rubber tiles made in Singapore. A saving of approximately \$1,000,000 is estimated in the cost of the Pontian Ketchil scheme, thanks to the vigilance with which the construction work has been carried out. Whereas this was at one time expected to cost \$19,000,000, it is now expected that the expenditure will be \$18,000,000 in this direction. Other expenses in connection with the scheme will add \$4,000,000 to this total.

# Extension of Lunghai Railway

**A**SECTION of the Lunghai Railway from Linpao to Tungkwan was completed in December 1931. This adds 72 kilometers to the railway (826 kilometers) which runs from Haichow, Kiangsu Province to Linpao, Honan Province. Construction work on the new section was started in 1924, or almost seven years ago, but due to the numerous internal disturbances, the work was interrupted many times. The section has five tunnels with an average length of four kilometers each and 30 bridges of an average length of 30 meters each. Judging from the number of tunnels and bridges in such a short section of railway, it is evident that the line passes a very mountainous country. Along the section, eleven stations are constructed, among which Linpao and Tungkwan are the principal ones.

The total cost of the section is reported to be Mex. \$9,000,000; derived from the following sources: (1) Mex. \$4,450,000 of the Mex. \$10,000,000 Construction Loan of 1924; (2) Mex. \$940,000 from the Lunghai Railway; (3) Mex. \$2,560,000 of the

Belgium Indemnity Refund and (4) Mex. \$1,000,000 from the Ministry of Railways.

The railway will be further extended to Sian. According to the plan of the Ministry of Railways, this section from Tungkwan to Sian with a distance of 131 kilometers will be completed before July, 1933. Already work has been started on the section of Tungkwan and Hauying, a distance of 24 kilometers from Tungkwan. It is reported that this section was ready for rails in March 1932, and that no less than Mex. \$100,000 has been spent for this section.

As estimated by the Ministry of Railways, the sum of Mex. \$14,000,000 is needed to complete this section to Sian. Of this sum, Mex. \$6,000,000 will be spent for the purchasing of steel rails, bridges, etc. from foreign countries; Mex. \$4,300,000 will be spent for the purchasing of locomotives and other wagons; and Mex. \$3,700,000 for other construction works.

After the completion of the section from Tungkwan to Sian, the railway will be further extended to Lanchow, capital of Kiangsu Province.



The Lunghai Railway

## Sulzer Boilers at Tientsin



In the Tientsin electric power station, (L'Energie Electrique de Tientsin), are two Sulzer boilers in service supplying steam for three Brown-Boveri steam turbines with a maximum capacity of 6,500 kw. The single bank upright water-tube boilers, each of 3,000 sq. feet heating surface, work at a pressure of 200 lbs. per sq. inch

and are equipped with traveling grate stokers, superheaters, economizers and induced draught fans. Each boiler raises normally 10 tons of steam per hour and can be forced to give 12 tons, the fuel used being Kailan coal with a calorific value of 10,620 B.Th.U. per lb.





Motor Vessel "Kirishima Maru" on Trial

## New Fast Cargo Motorships "Kirishima Maru" and "Katsuragi Maru"

Vessels Built for the Orient-New York Service of the Kokusai Kisen Kaisha Have Unprecedented Features of Design and Construction

By Y. TAJI, M.I.N.A., M.I. Mar.E.

THE *Kirishima Maru* was built by the Kawasaki Dockyard of Kobe and the *Katsuragi Maru* by the Uraga Dockyard, both to the order of the Kokusai Kisen Kaisha, Ltd. and are ranked among the world's fastest cargo boats.

The *Kirishima Maru* was laid down on August 6, 1930, launched on April 3, 1931, completed on July 5, 1931, and commissioned on July 9, 1931, whilst the *Katsuragi Maru* was launched on May 15, 1931, and completed on October 2, 1931.

The principal particulars and leading characteristics are as follows:—

Length over-all ... ... ...	466-ft. 0-in.
Length between perpendiculars... ...	440-ft. 0-in.
Breadth moulded... ...	60-ft. 0-in.
Depth moulded ...	40-ft. 0-in.
Full loaded draught ...	26-ft. 1.21-in. (26'-3.16")*
Gross tonnage ...	5,959.01 tons. (5,840)
Registered tonnage ...	3,552.64 tons. (3,504)
Under deck tonnage ...	5,371.15 tons. (5,239)
Dead weight ...	8,753.58 tons. (8,672)
Cargo capacity, grain ...	628,309 cub. ft. (622,439)
do. , bale ...	579,488 cub. ft. (562,550)

### MAIN ENGINES.

(For the *Kirishima Maru*), one set of M.A.N. double acting, two cycle, airless injection Diesel engine with normal output of 6,000 b.h.p. at 95 r.p.m.

(For the *Katsuragi Maru*), one set of Mitsui-B. & W.'s, single acting, four cycle, solid injection, super-charged Diesel engine with normal output of 6,000 b.h.p. at 115 r.p.m.

### SPEEDS.

Mean trial, knots ... ...	18.029 (17.75)
Fully loaded, knots ... ...	16.0

The vessels were constructed under special survey of the Imperial Japanese Government and of Lloyd's Register of Shipping,

and are classified as First Class Ocean Service Vessels by the former and as  $\blacksquare$  100A1. with L.M.C. by the latter.

The vessels being similar in the hull construction and general arrangement, except the machinery room arrangement owing to difference of the propelling machinery, the description hereinafter refers to the *Kirishima Maru*, unless otherwise noted.

### Structural Design and General Arrangement

The ship's form was very carefully decided under exhaustive model tests in the experimental tank of the Ministry of Communications in order to ensure the most economical shape of propulsion for such a fast cargo vessel. The results of progressive trials confirmed that the selected lines are very suitable to this class of vessels, giving a very low resistance and a very high propulsive efficiency.

The vessel is of an open shelter deck type, first adopted in Japan, which was considered by the Kokusai Kisen Kaisha as the most suitable type for the world-round operation, saving considerably in canal fees, etc. The tonnages of the vessel, when the openings are closed down, are about 10,043 tons d.w., 8,100 gross tons and 4,900 registered tons at a full load draught of 28-ft. 3-in., whilst the open tonnages are 8,753.58 d.w., 5,959.01 gross tons and 3,552.63 registered tons.

The vessel has many special or unique features in design and construction as well as in fittings and equipment.

Structural scantlings of the vessel are much heavier than those required by classification societies, as it has been so often experienced by Japanese naval architects that usual scantlings by rules have been hitherto inadequate for high speed cargo motorships.

In the vessels, deck plating, stringer plates and angles, sheer strakes and strakes below are increased by 10 per cent in thickness over Lloyd's requirements in order to ensure sufficient stiffness and

\*Figures in brackets are for the *Katsuragi Maru*.

to provide against corrosion. Upper edges of tank side margin plates are flanged outwards in order to effect as continuous gasket plates. For providing against panting, most parts of outside plating near L.W.L. in way of No. 1 hold are increased about 20 per cent in thickness over the regulations, and also deep frames being arranged, panting stringers have been dispensed with.

Transverse frames are spaced 36 inches distant, except one-fifth length of the ship at the forward end and in aft peak tank, against 32 inches of the frame spacing required by Lloyd's. All bulkhead stiffeners have brackets at the top, while the bottom parts are lugged in order to avoid a broken stowage and for the convenience of embarkation.

A pipe tunnel is arranged in forward cargo holds for the convenience of inspection and repair of suction oil pipes to each fuel oil tank in the forward double bottom. The engine is placed directly on the inner bottom and fastened by bolts piercing top angles of coffer-dam walls. The double bottom space under the engine room is considerably increased in height and strongly reinforced in structural strength.

Stringer angles of the shelter deck are fitted underneath the stringer plates; consequently the bulwarks are recessed inward about one foot to leave freeing port sills as low as possible. All compensating plates, straps, etc., are fitted underneath the deck plating in order to avoid any obstruction on the deck and to have a plain clear deck.

Deep tanks are divided by longitudinal cofferdams to avoid mixing of oils when different kinds of oils are shipped in adjacent compartments. Derrick posts and ventilators which pass through the shelter deck, are utilized as widely spaced pillars for avoiding broken stowage as far as possible.

The vessel has a raked straight stem and a cruiser stern with a special rudder ("Simplex" for the *Kirishima Maru* and "Ertz" for the *Katsuragi Maru*). Over the shelter deck are a saloon deck, a boat deck, a flying bridge and a compass bridge. There are two pole masts, three pairs of twin posts and one large dumpy funnel, so the vessel has a well-proportioned and graceful appearance.

The shelter deck and the second deck are continuous extending over the whole length of the ship, whilst the third deck is discontinuous. The vessel is subdivided by eight watertight bulkheads into fore and aft peak tanks, six cargo holds, seven upper and lower 'tween deck spaces and a machinery room. No. 3 and No. 4 holds are subdivided by center line bulkheads and well-isolated from other compartments, as these are used as deep tanks for the carriage of various cargo oils amounting 1,600 tons. The double bottom is extended over the whole length between the fore peak tank and aft peak tank, and is utilized for the stowage of fuel oil or for ballast water, for that fifteen tanks and two wing tanks are arranged.

Under the engine room are fresh water reserve tanks, lubricating oil drain and settling tanks, etc.

It should not be overlooked that special precaution has been taken for the improvement of officers' and crew's accommodations and particularly for the generous treatment of men of lower ranks.

On the boat deck forward, are two state rooms, captain's rooms, second and third officer's rooms, a gyro-compass room, bath and lavatory, whilst at the after part are sick-bay.

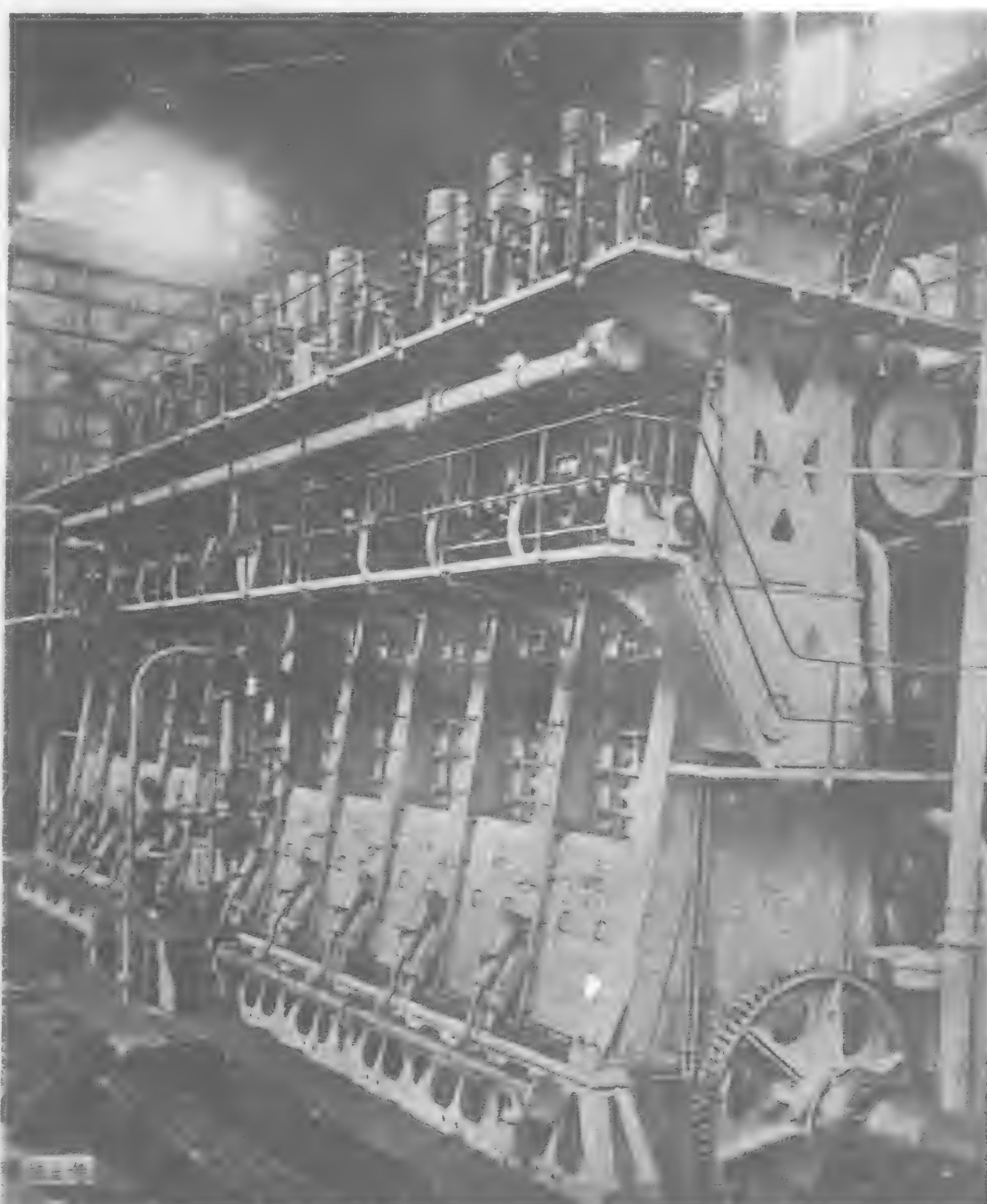
The saloon deck is arranged for a spacious dining-saloon and a smoking-room, two state rooms, chief engineer's room, chief officer's

room, engineer's cabins, clerk's and chief steward's cabins, apprentice's cabin, pantries, a mess-room, officers' and engineers' baths and lavatories, etc.

The crew's rooms are comfortably accommodated on the shelter deck amidships below the saloon deck, most of them for two persons. There is also a spacious mess-room on the front and a large galley aft.

Thus, all members of the ship from the captain to the lowest rank can fully enjoy fresh air and good sunlight together, with every modern convenience, which is unparalleled in this class of vessels.

The dining-saloon and smoking-room are very artistically decorated in the modern European style, but with much seasoning of Japanese taste, for which the builders made special endeavor. The rooms are cosy and pleasing with every comfort, just as in a passenger liner. The saloon has seating accommodation for twenty persons, the ceiling being panelled with veneered wood and painted mat white, whilst the side walls are ceiled with veneer



Main Engine of the Motor Vessel "Katsuragi Maru"

planks finished in cream white color. The floor is covered with special deck composition and linoleum laid over it, having fine carpet runners and door mats. The furniture is of Japanese oak fumed in dull color and comprises two circular and rectangular dining tables, comfortable armchairs covered with pegamoid, an U-shaped sofa lined with fine Japanese cloth, a beautiful sideboard, two radiator boxes, etc. Windows are of pure Japanese style imitating the circular windows of a Japanese tea ceremony room, and curtains are also of special Japanese cloth to match the general decorative system.

The smoking-room has seating for six persons and is decorated in the same style. The ceiling is panelled with veneer wood finished in dull white. The beams are cased in with Japanese oak. Side walls are lined with veneer planks, painted a light green color, having high dado of teak and special Japanese hard wood called "keyaki," designed in arrow pattern. Between the saloon and the smoking-room, beautiful silk curtains and old-fashioned iron grating are provided. Various tables for indoor games such as "Go" (Japanese war game), Mah Johng, chess (Japanese and European

style), card table, etc. are provided together with comfortable furniture tastefully upholstered.

### Cargo Facilities

The exceptionally large cargo capacity is also a speciality of this vessel. Taking 70 cub. ft. for grain of one ton and 64 cub. ft. per bale, the cargo capacity is 20-30 per cent larger than ordinary cargo vessels of the same size and is equal to the dead weight capacity of the largest cargo ship of Japan, as shewn below:—

Upper 'tween decks (grain in cub. ft.)	...	...	199,219
Lower , , ,	...	...	134,863
Holds	...	...	291,426
			<hr/>
	Total ...	...	625,508

At the lower 'tween deck of No. 5 cargo hold are two silk rooms at both sides of the hatchway, the total capacity being 13,660 cub. ft. Special arrangement is provided for the insulation of heat and excess humidity.

All winches are electrically driven with efficient devices for speedy handling as well as for creeping motion, so as to ensure the utmost safety and reliability in handling of valuable cargoes. These were all supplied by the Mitsubishi Nagasaki Works.

It should not be overlooked that an unusual number of winches is installed, whilst three Mannesman's steel derrick booms are fitted to each hatch end, in which the middle boom can be worked for two adjacent hatchways, so that the cargo handling facility of this vessel is about twice as large as that of the ordinary type. The disposition of derricks and winches is as follows:—

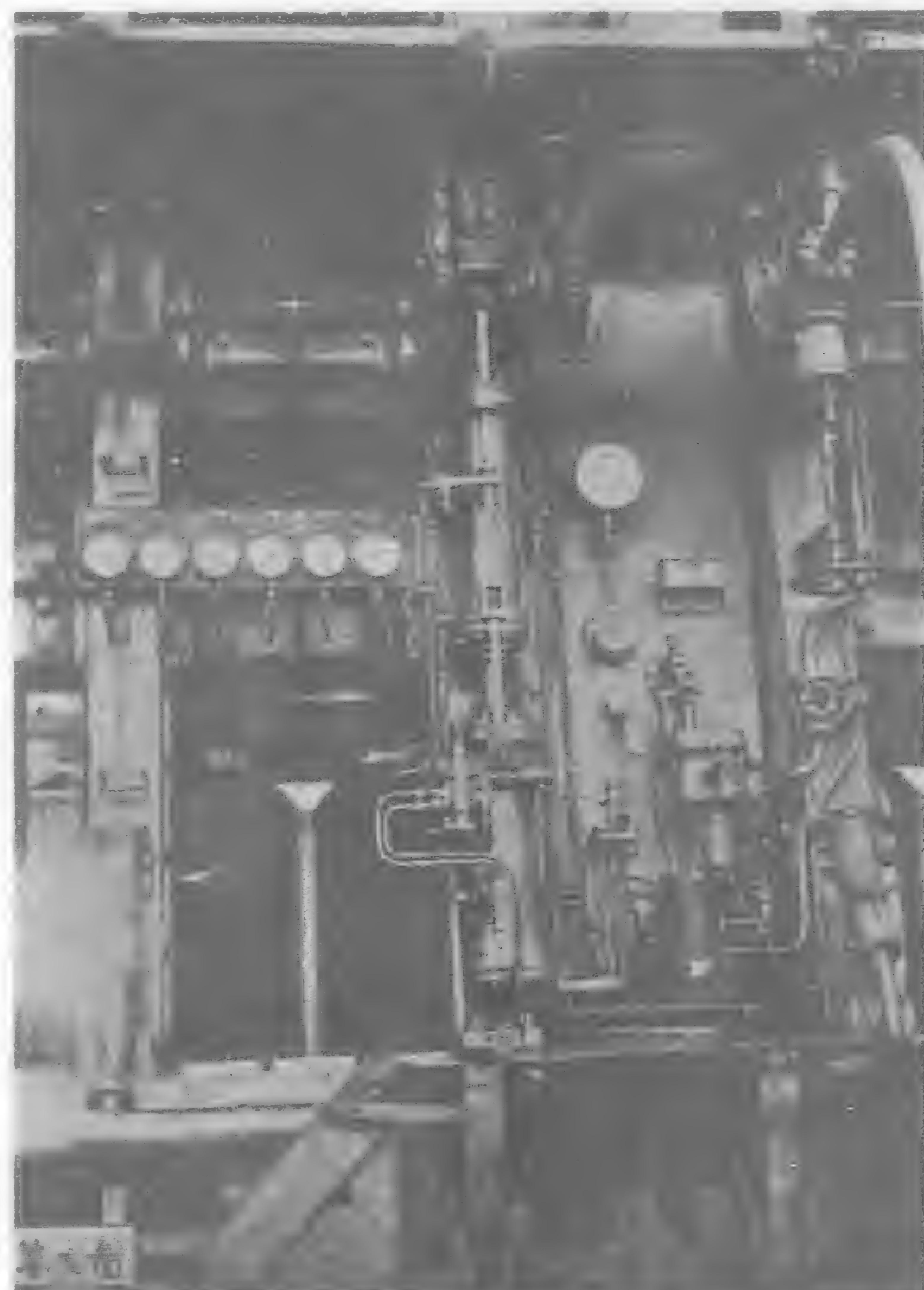
Hatch No.	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
	2-5T	2-10T	3-5T	3-5T	3-5T	2-5T	2-5T
Derricks	on posts	posts			posts		
	1-5T	1-30T	on posts	on posts	2-5T	on posts	on posts
	on fore	f. mast					
	mast	3-5T					
		posts					
	1-3T	2-5T	3-3T	3-3T	3-3T	2-5T	1-5T
Winches	2-5T	fore end		fore end			
	at	3-3T	at	at	2-5T	at	
	aft end	aft end	fore end	aft end	aft end	fore end	mooring

All five ton winches, except the mooring winch, are driven by electric motors of 46 h.p. at 350 r.p.m. each, and have a lifting speed of 130-ft. per min. at full load and 450-ft. per min. at light hook, while three ton winches are driven by motors of 33 h.p. each at 440 r.p.m. the lifting speeds being 120-ft. per min. with load and 450-ft. per min. at light hook. All motors are of D.C. compound wound type working at 220-volts.

### Anchoring, Mooring and Steering Arrangement

An electric windlass for 2 $\frac{1}{2}$  inch cables is installed on the forecastle deck, having a hauling speed of 30-ft. per min. at a load of 18 tons. A driving motor with an output of 80 h.p. at 220-volts—700 r.p.m. is installed in the motor room under the forecastle deck. The complete windlass was manufactured by the Kawasaki Dockyard.

There are three bower anchors, one being spare, of over 733 cwt. and cables of 300 fathoms long and 2 $\frac{1}{2}$  inches in diam., these sizes being heavier than Lloyd's requirements.

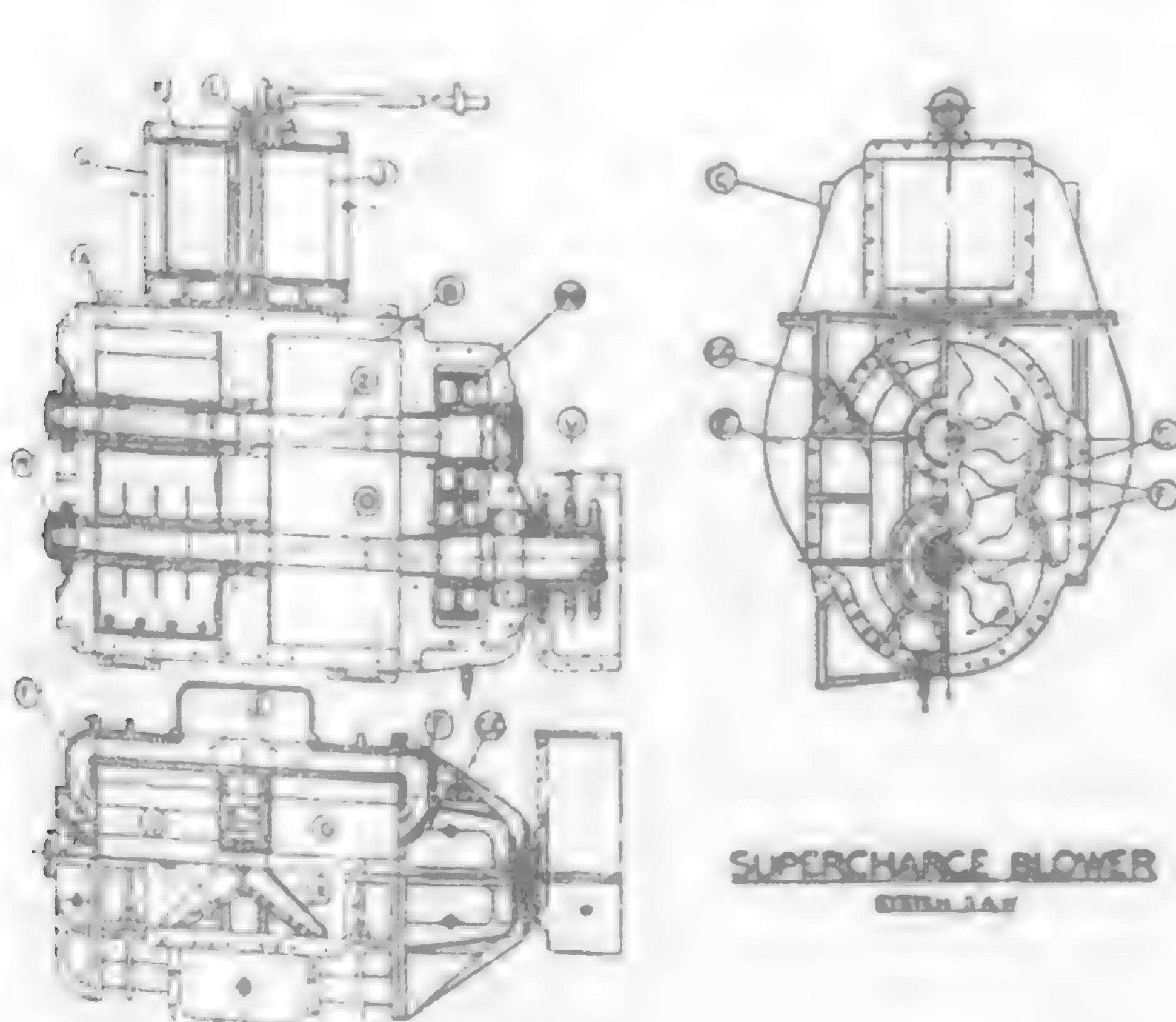


Main Engine Starting Devices of Motor Vessel "Katsuragi Maru"

Special care has been taken for the mooring arrangements. A mooring hawse pipe is fitted at the port side bow for securing cables to a buoy, while a hawse pipe for the stream anchor is provided at starboard stern. The winch to No. 7 hatchway is utilized as the mooring winch, which is driven by an electric motor of 57 h.p. at 420 r.p.m., the speed being 110-ft. per min. for a load of five tons, while 55-ft. per min. for a load of 10 tons which corresponds to the general case of mooring; consequently no capstan is provided. Further, bollards, fairleads, etc. have been made unusually strong and considerably increased in number.

The steering gear is of an all-electric type controlled by means of the Leonard Gear, fitted with an auxiliary hand gear. The steering motor has an output of 7.4 kw. at 180-volts—50 amps. and 400 r.p.m. The mechanical part was supplied by the Atlas Werke of Bremen, whilst the Leonard Gear by A.E.G. of Germany (for the *Katsuragi Maru* the complete machine was made by the Uraga Dock Co.)

The vessel is equipped with a "Simplex" patent rudder, for the first time adopted on a Japanese ship, the easy and economical handling of which was confirmed in sea trials with a considerable saving of power and very small turning circles. (In the *Katsuragi Maru*, an "Ertz" rudder is adopted). In order to ensure efficient steering at sea, an Anschütz's automatic steerer is fitted in these vessels.



Motor Vessel "Katsuragi Maru" Main Engine Super-Charger

## Navigating, Communicating and Life-Saving Appliances

All necessary navigating appliances of the most up-to-date types are provided on the flying bridge, compass bridge, docking bridge, etc. These comprise a Lord Kelvin's patent standard Azimuth compass with 10 inch card on the compass bridge; two 10 inch patent liquid steering compasses, a complete set of Anschütz's gyro-compass and repeaters, a Tresdient electric ship log, and other necessary nautical instruments, the compasses and logs having been supplied by Messrs. Kelvin, Bottomley & Baird, Ltd.

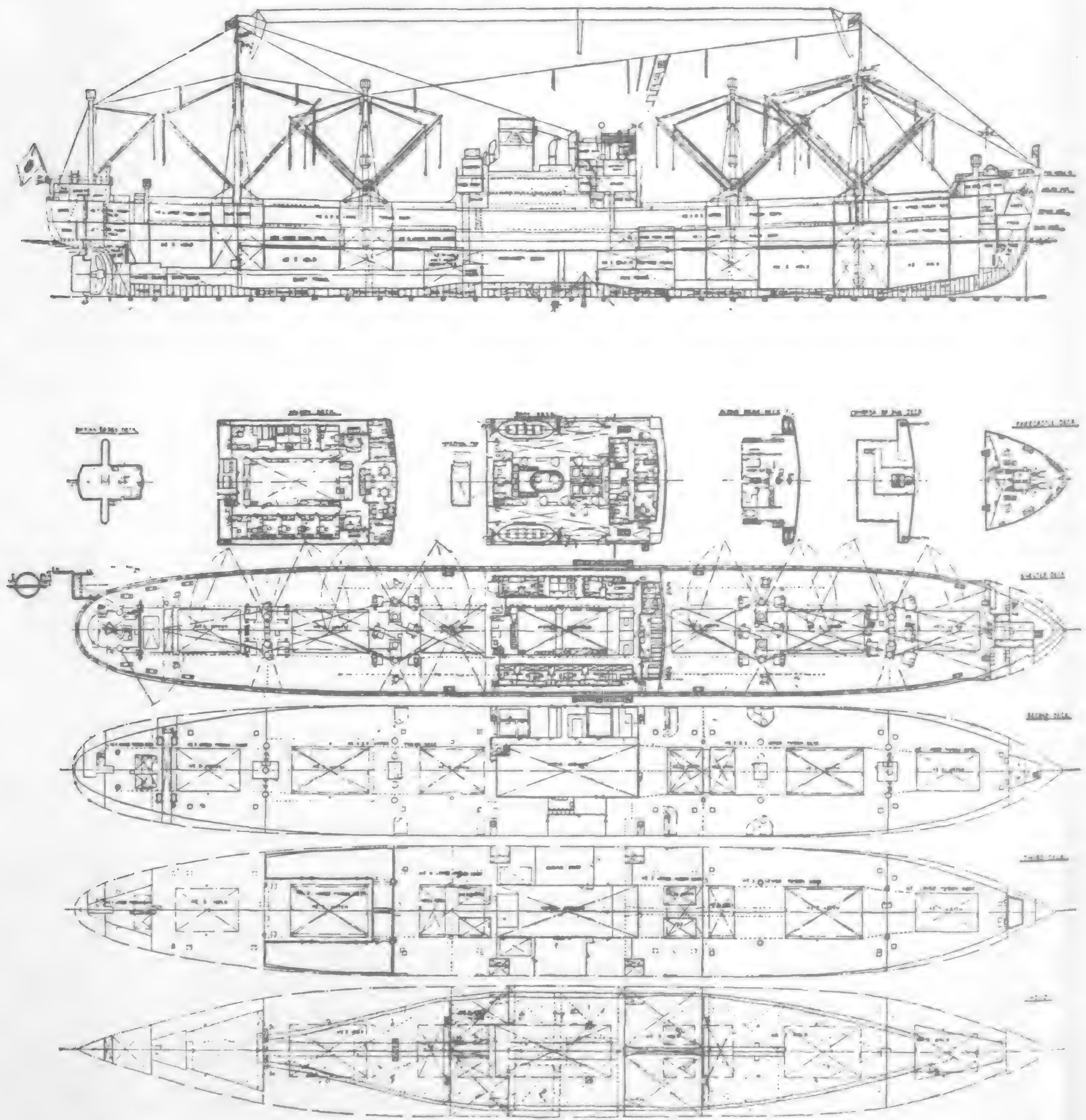
As to the communicating appliances, there are telegraphs, telephones, wireless apparatus, voice pipes, signals, etc. The telegraphs consist of one set of engine telegraph transmitted by 12 inch dial and received by 16-in. dial, and another set of steering and docking telegraphs of the same size, both being of Noda's Robinson type manufactured by the Noda Optical Factory in Japan. There are two systems of loud speaking telephones, one from the flying bridge to the docking bridge, engine room and forecastle deck, and the

other being the inter-communication between the flying bridge, captain's room, chief engineer's room and the engine room. These are "Loudphones" supplied by Messrs. Clifford & Snell, Ltd. of Croydon.

For wireless telephony and telegraphy, three sets of wireless apparatus are provided in the wireless room on the flying deck. No. 1 set is of "Auritsu" bulb type with a capacity of 1.5 kw. and No. 2 set is of the same type of 500 watts, while the third one is an auxiliary set of the "Auritsu" quenched spark gap type with a capacity of 250 kilowatts, all having been manufactured by Auritsu Electrical Company, Ltd. The direction finder is of Telefunken type with eight tubes supplied by the Nippon Wireless Telegraphy and Telephony Co., Ltd.

As to the life-saving appliances, two 28-ft. life-boats and two 20.5-ft. "Tenma" (Japanese junks) are stowed on the boat deck, these being worked by patent quadrant davits made by the Uraga Dock Co., Ltd. in conjunction with cargo winches to Nos. 4 and 5 hatchways.

S.S.M.S. KIRISHIMA MARU.  
GENERAL ARRANGEMENT.



## Ventilating, Heating, Lighting, Fire-Extinguishing and Refrigerating Appliances

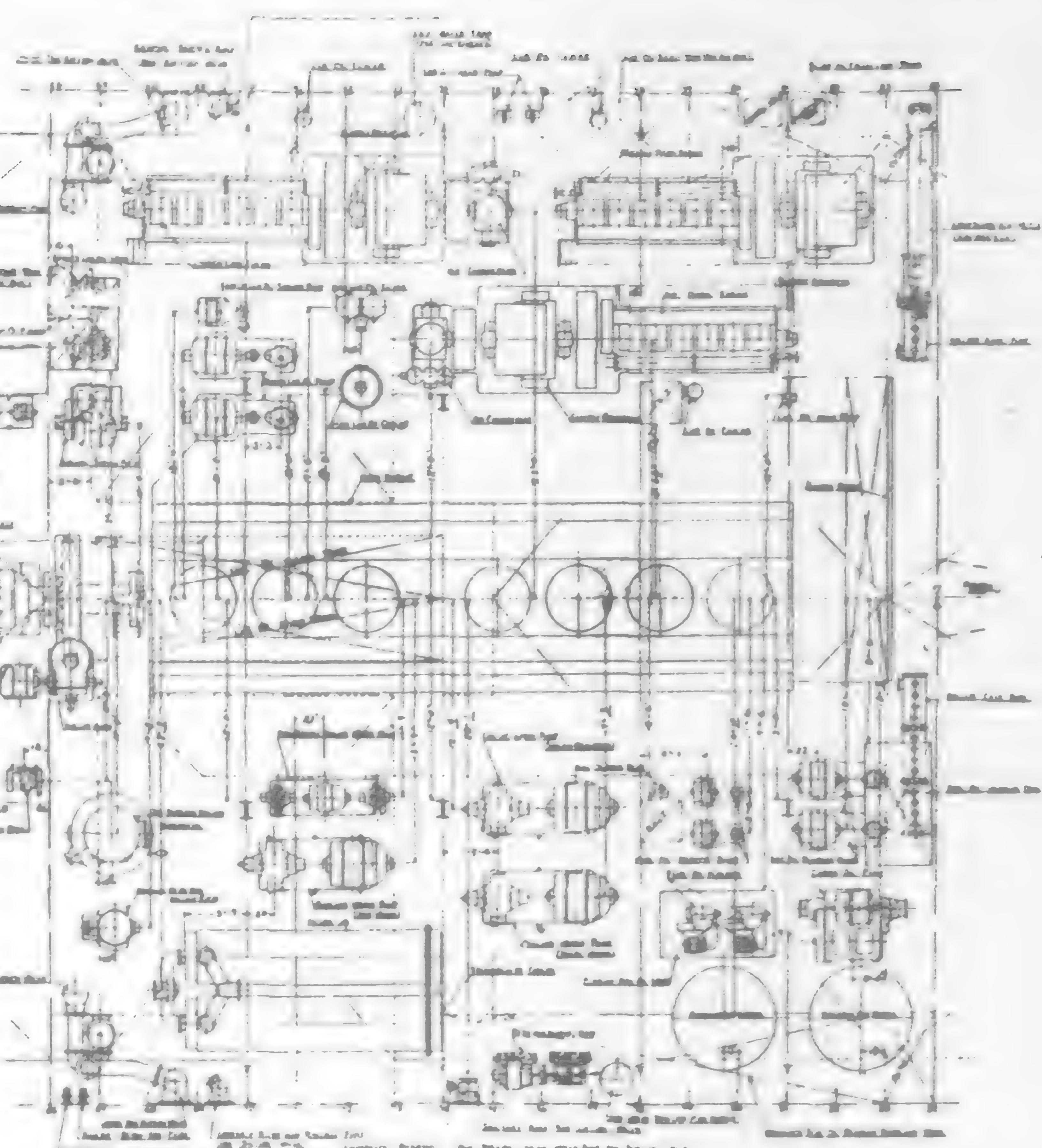
Special care was taken for the ventilating system of cargo holds, machinery space, etc., as the vessel carries various goods of superior quality. In ventilating cargo holds and 'tween deck spaces, usual cowl head ventilators of 35 or 36-in. are used for the down cast, whilst Boyle's ventilators of 30-36-in. for the uptake. These ventilators are fitted at watertight bulkheads and are led to the ship's sides through air trunks in order to avoid any possible obstruction to cargo loading and unloading.

For the machinery space, two 30-in. ventilators are fitted with a fan engine, which can draw or expel the air through the ventilators and also assist the natural ventilation whenever required. Further, six 36-in. cowheads are fitted on the top of the engine room casing.

All living quarters are ventilated by the natural system with plentiful number of mushroom ventilators together with portable electric fans and ceiling fans in public and private rooms.

The heating of the vessel is effected by steam of 40 lb. per sq. in. taken from the Clarkson's exhaust gas boiler, through cast iron radiators for the living quarters and engine room. Deep cargo oil tanks have grids of steam piping for the shipment of cocoa-nut oil, while fuel oil tanks have steam heating coils, steam being supplied by the Clarkson's boiler at 100 lb. per sq. in., in both cases. Exhaust steam from the radiators and heaters is led to a boiler feed water tank. All large cooking apparatus such as cooking ranges, Japanese rice boilers, etc. are of oil burning types.

The vessel is illuminated throughout by electricity including signal lamps, etc. There are fourteen cargo lamps, each comprising



M.V. "Kirishima Maru" Machinery Arrangement

a group of four 100 watts lamps. In addition, four electric projectors of 500 watts each are fitted, two on the aft end of boat deck and others on the compass bridge, for throwing lights upon quarter deck and forward deck respectively.

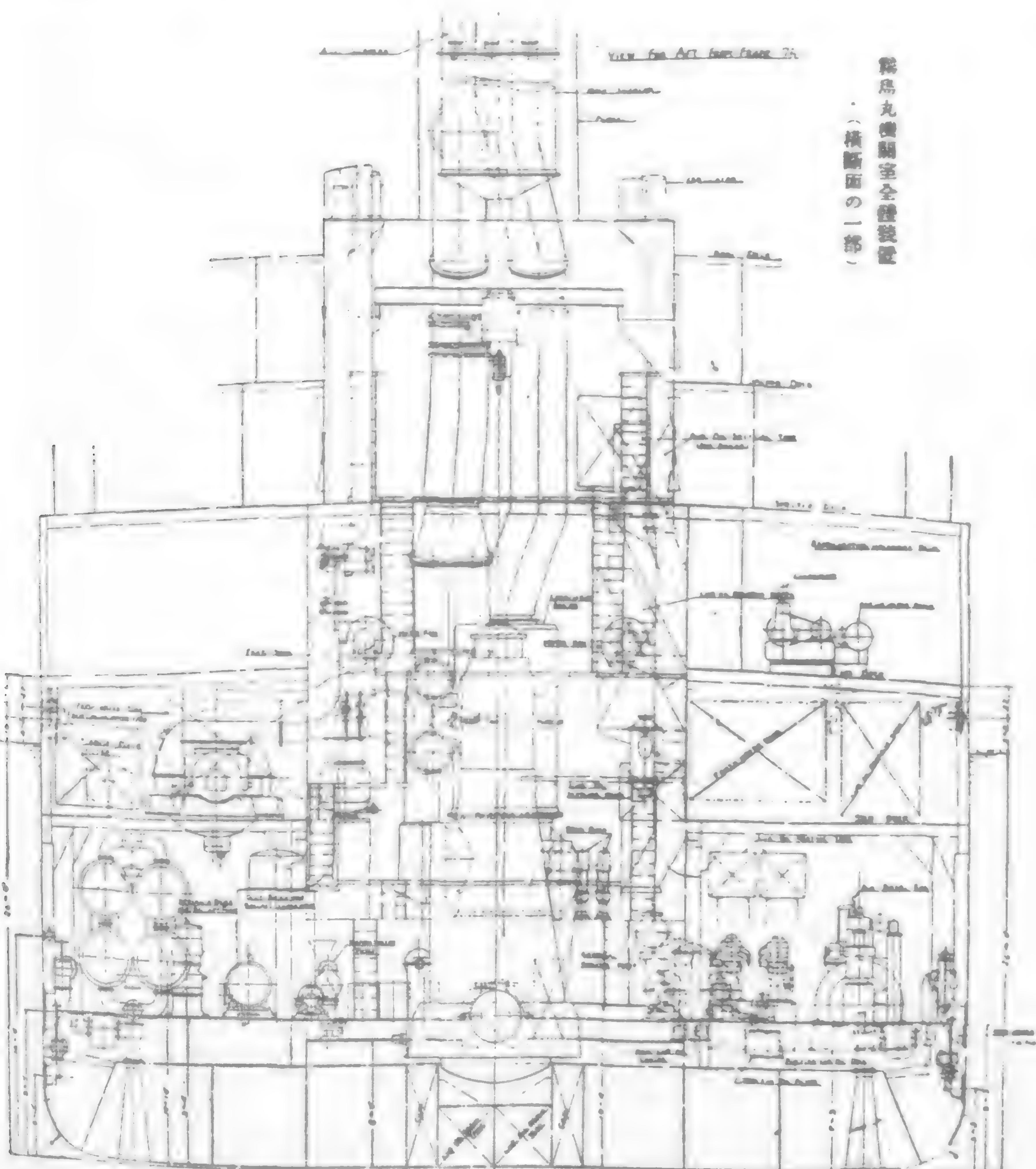
In view of carrying silks and other valuable goods, the fire-extinguishing appliances are very complete, for that Walker's liquid CO<sub>2</sub> fire extinguishing system is adopted, which was supplied by Walker & Cie., A.G. of Köln-Dellbrück, Germany. Seventy-three bottles of 335 litres in capacity containing 28 kgs. of CO<sub>2</sub> are stowed in a special room on the upper 'tween deck. Pipes of  $\frac{3}{4}$ -in. in diam. are led from the bottles to all cargo spaces, fitted with two or four CO<sub>2</sub> gas discharging nozzles of  $\frac{1}{2}$ -in. diam. in accordance with the volume of the space. In the engine room, steam fire-extinguishing nozzles are provided together with four sets of the Yamato's fire extinguishers made in Osaka. (For the *Katsuragi Maru*, "Lucksrich" fire-annihilators are adopted).

The cold stores comprise a vegetable room of 462 cub. ft., a meat room of 382 cub. ft. and a lobby of 236 cub. ft., totalling 1,080 cub. ft., for which a "Seager's" CO<sub>2</sub> multi-effect refrigerating machine of 18,000 B.T.U.s. is installed in an adjacent room to the cold stores. In tropical districts, this machine can keep the meat room at 20 deg. Fah. and the vegetable room at 30 deg. F. in working for 10 hours in a complete day, and also can make 150 lb. of ice at the same time. (In the *Katsuragi Maru*, an "Auto-frigor" machine is installed).

### Main and Auxiliary Machinery

#### (I). FOR THE "KIRISHIMA MARU."

**MAIN ENGINE.**—The ship is propelled by one set of M.A.N. D7ZU70/120 type two cycle, double acting, airless injection Diesel engine, with seven cylinders of 700 mm. bore and of 1,200 mm. stroke, the normal output being 6,200 b.h.p. at 95 r.p.m.



M.V. "Kirishima Maru" Transverse Section Machinery Room

The total length of the engine is 12,135 mm., the height from the center line of crank shaft to the top of the cylinder covers being 7,420 mm., while the whole width is 4,300 mm.

The cooling of cylinder jackets, covers and pistons is effected by fresh water, for that three sets of electric driven centrifugal cooling water pumps with a capacity of 400 cb. meters per hour, a fresh water re-cooler with a cooling surface of 500 sq.m. and two port service cooling water pumps of electric centrifugal type with a capacity of 30 m. per hour each are installed in the engine room, the pumps being supplied by the Atlas Werke of Bremen, whilst the motors by Siemens-Schuckert A.G. of Berlin.

Scavenging air is supplied by a Brown-Boveri's turbo-blower with a capacity of 800 cub. m. per min. at 1,125 kgs. per sq. cm. at 2,200/2,950 r.p.m., this being independently driven by a 220-volts—245 kw. electric motor.

Air compressors are fitted to two Diesel generators and one emergency Diesel dynamo set, the former being of 3-stage type of 325 cub. m. per hour at 30 atms., while the latter is of 2-stage type of 20 cb. ft. per hour at 30 atms. For supplying starting air to the main engine, two starting air reservoirs are provided, each having a capacity of 12,000 litres at 30 atms. Further, a Diesel dynamo starting air reservoir of 400 litres at 30 atms. and an emergency Diesel dynamo starting air reservoir of 90 litres at 30 atms. are installed in the engine room. All the reservoirs were supplied by M.A.N. Augsburg Works.

Exhaust gas is led to a Clarkson exhaust gas boiler in order to generate steam for heating, cooking and other purposes; naturally exhaust pipes are not water-cooled, but lagged only with asbestos.

**ELECTRIC GENERATING AND AIR COMPRESSING PLANT.**—There are three main Diesel generator sets in the engine room and one emergency Diesel dynamo compressor set on the second deck amidships. Two of the main Diesel generators are directly coupled to the air compressors mentioned before through friction clutches, each set comprising a M.A.N. G6Vu42 type four cycle, solid injection Diesel engine with six cylinders of 290 mm. bore and 420 mm. stroke, developing 350 b.h.p. at 375 r.p.m. and a 230-v.—235 kw. D.C. compound wound dynamo and a 3-stage air compressor. The third main generator is a pure Diesel dynamo set of the same capacity, but without compressor. Cylinders and covers of these engines are cooled by fresh water as in the main engine, but pistons are not cooled. The engines were built by M.A.N. Augsburg Works, the dynamos by Siemens-Schuckert A.G., while the compressors by Balche Works, Germany.

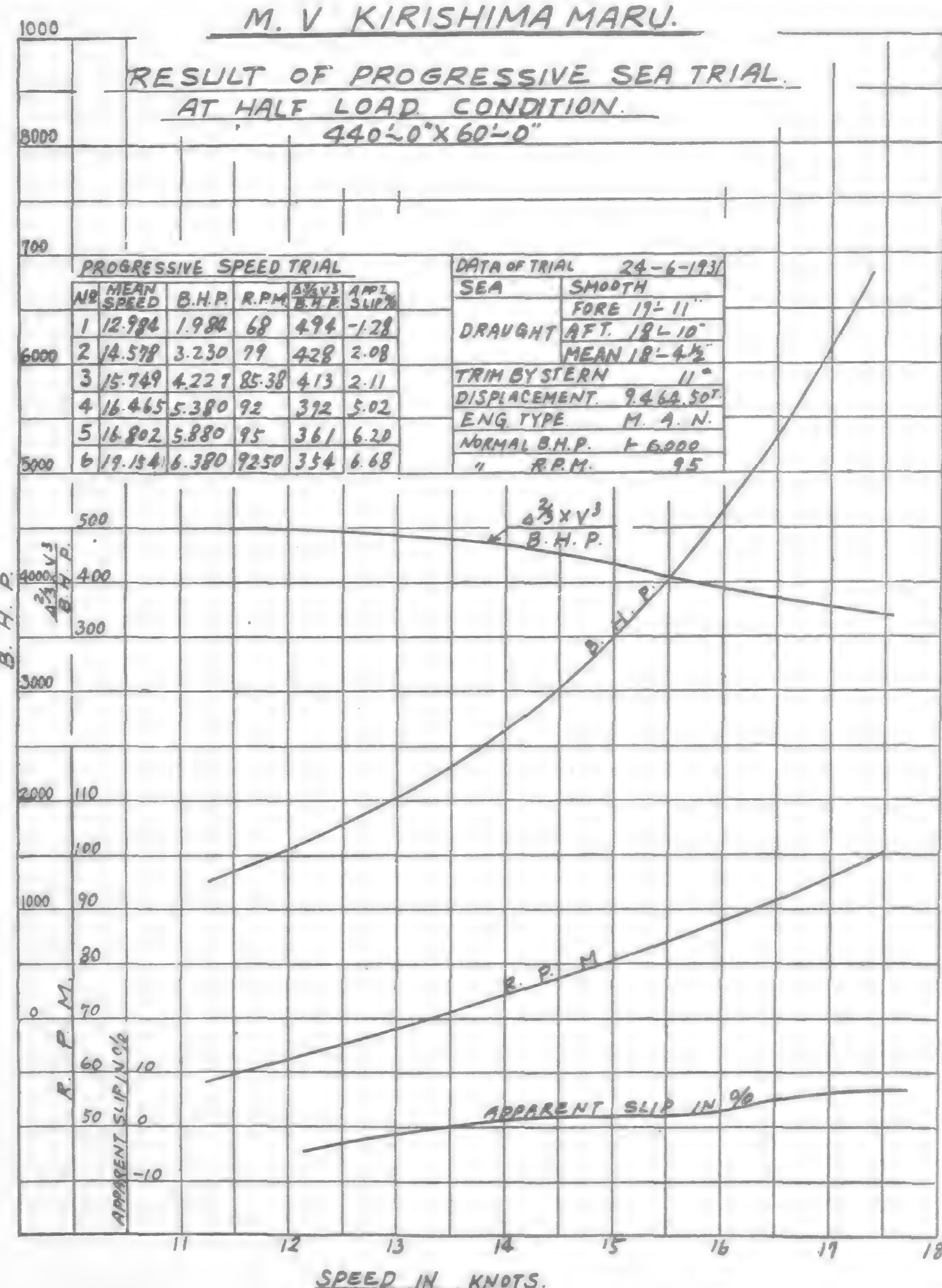
The emergency Diesel dynamo compressor set consists of a Körting four cycle, solid injection Diesel engine with four cylinders

of 140 mm. bore and 180 mm. stroke, developing 36 b.h.p. at 600 r.p.m., whilst the dynamo is of Vicker's D.C. compound wound type with an output of 20 kw. at 225-volts, the air compressor having been made by the Kawasaki Dockyard.

**STEAM GENERATING PLANT.**—For the generation of steam, an exhaust gas boiler of Clarkson Begatoo 550 type with Clyde oil fuel burning system is installed at the aft part of the engine room, and it has a heating surface of 550 sq. ft. and a working steam pressure of 100 lb. per sq. in. Steam can be generated even in port by using oil fuel burners. The boiler was supplied by Messrs. Babcock & Wilcox Co., Ltd.

As to the auxiliaries to this plant, there are two Weir's feed pumps of 600 gals. per hour, one surface condenser for the feed pumps with a cooling surface of 0.475 sq. m., one Clarkson's thermal feed water regulator, one condenser with a cooling surface of 6.5 sq.m., one evaporator of Weir's type with a capacity of 10 tons per day, one distiller of the same type of 5,000 gals. per day. All this auxiliary machinery was made by the Kawasaki Dockyard, except the feed water regulator which was supplied by the Clarkson Thimble Tube Boiler Co.

**ENGINE ROOM AUXILIARY MACHINEY.**—Apart of those mentioned before, the following auxiliaries are installed in the engine room:



- 1—Bilge and ballast pump of Drysdale's type with a 18 h.p. D.C. motor and a capacity of 150 cb.m. per hr.
- 1—Fresh water pump of Weir's type with a 3 h.p. motor and a capacity of 10 tons per hour.
- 2—Neidig's lubricating oil pumps of gear type with a 20 kw. motor and a capacity of 55 cb.m. per hour.
- 1—M.A.N. lubricating oil cooler with a cooling surface of 48 sq. meters.
- 1—Neidig's standby lubricating oil pump of gear type with a 2.6 kw. motor and a capacity of 6 cb.m. per hour.
- 1—Weir's general service pump with a 30 h.p. motor and a capacity of 80 cb.m./hr.
- 1—Weir's cargo oil pump of 150 cb.m. per hour with a 30 h.p. D.C. motor.
- 1—M.A.N. fuel oil hand pump of piston type.
- 3—Lubricating oil hand pumps of the same type.
- 3—M.A.N. lubricating oil cooler of 3.5 sq.m.

2—Sharples fuel oil purifiers of 300 gals. per hour with a 1.5 kw. motor.  
 1—Mayer's oily bilge and ballast separator of "Turbulo" type of 100 tons per hour.  
 2—De Laval's lubricating oil purifiers of 300 gals. per hour with a 1.5 kw. motor.  
 1—M.A.N. lubricating oil filter for the main engine, change-over type.  
 3—M.A.N. lubricating oil filter for the auxiliary engines, of the same type.  
 2—Sirocco exhaust fans for ventilation driven by a 3 h.p. motor.  
 1—Five ton electric travelling crane.  
 1—M.A.N. fuel oil filter for the main engine.  
 3—Ditto for the auxiliary engines.  
 2—Fuel oil filters for pump station.  
 1—Ditto for filling station.

All pumps of Weir's and Drysdale's types and the majority of the auxiliaries, not specially stated, were made by the Kawasaki Dockyard.

Further, an 8-ft. lathe, a 1½-in. drilling machine, a grinder and other necessary tools are completely furnished in the engineers' workshop.

**PROPELLER.**—The vessel has a single screw propeller of right-handed turning with four loose blades of manganese-bronze, the diameter being 5.486 meters, mean pitch 5.822 meters, and developed area 8.63 sq. meters, manufactured in the Kawasaki Dockyard.

## (II). FOR THE "KATSURAGI MARU."

The general arrangement and hull construction of the *Katsuragi Maru* are practically same as those of her sister ship *Kirishima Maru*, but the main engine being of fundamentally different type, the engine room arrangement together with types of the auxiliary machinery is quite different from the latter.

**MAIN ENGINE.**—The main propelling machinery of the *Katsuragi Maru* comprises one set of Mitsui-B. & W.'s single acting, four cycle, airless injection, pressure-charged Diesel engine with the following particulars:—

Type	...	...	...	...	...	D.E.1074-TF-150.
No. of cylinders	...	...	...	...	...	10.
Diameter ,,	...	...	...	...	...	740 mm.
Stroke	...	...	...	...	...	1,500 mm.
I. H. P. (at normal load)	...	...	about	...	7,000	
B. H. P. (,,,,)	...	...	...	...	6,000	
R. P. M. (,,,,)	...	...	...	...	115.	
Total engine weight, including thrust shaft and bearing	...	...	...	...	465 tons.	
Over-all height	...	...	...	9,200 mm.		
Height from bottom of bed plate to the top of cylinder covers	...	...	...	7,620 mm.		
Width of bed plate	...	...	...	3,800 mm.		
Over-all length	...	...	...	17,680 mm.		

Thus, the engine developing 6,000 b.h.p. at normal load and 6,900 b.h.p. at over load with 121 r.p.m., it is considered as the largest unit in the world for a single acting four cycle Diesel engine adopted with the solid injection system. This super-charging system has been solely developed by the Mitsui Tama Works, as it has not been hitherto adopted in any large unit of Burmeister & Wain type.

The engine comprises two parts of fore and aft groups, each consisting of five cylinders; and between them, a cam shaft and roller chain gear for operating the super-charging blowers are arranged. The Brown's manoeuvring gear is fitted at port side of the engine casing, whilst on the starboard middle platform are two sets of supercharging blowers of Root's type, which are enclosed in two casings and driven by the crank shaft through the chain gearing.

The characteristic of this engine is in the adoption of solid injection system to such a large unit and of the high pressure super-

charging. Fuel pumps are independently fitted to each cylinder in order to annihilate the irregularity in fuel supply and the trouble for adjustment. The Mitsui-B. & W. super-charging system differs from other systems in its principle, that in this engine pressure-air is not used for filling cylinders but usual atmospheric air is drawn in, whilst the pressure-air is used only for the scavenging and super-charging operations so as to reduce the consumption of super-charge air and the capacity of super-charging blowers with consequence that the blowers are directly driven by the main engine owing to a great reduction of power required for them. In order to execute such a cycle, special super-charging valves were invented by the Tama Works, and after exhaustive tests it was confirmed that the required quantity of super-charge air is only one half that of other systems hitherto introduced, and the power required for driving the blowers is only 4 per cent of s.h.p. of the engine.

The cooling and lubricating systems are as usual in this type of engines, i.e. cylinders by fresh water, pistons by cooling oil, exhaust valves by sea water, while bearings, crossheads, etc. are forced lubricated.

Apart from the fuel oil injection pumps and super-charging blowers, the auxiliaries directly fitted to the main engine are a 20 ton bilge pump and a 20 ton sanitary pump, both of a plunger type,

In shop tests, the fuel consumption of this engine was recorded as 173.8 grams per b.h.p. per hour and the mechanical efficiency 85.23 per cent, whilst in her maiden voyage the fuel consumption was 170 gms. per b.h.p. per hr. at a mean sea speed of 16.04 knots. On the test bed, the super-charge pressure was adjusted to keep about 3 meter of water column. In suction stroke, the initial pressure was 2.6 metres and the exhaust back pressure was about 0.1 atms. which is considerably low in comparison with usual records of 0.25-0.27 atm. under the ordinary exhaust turbine system.

**ELECTRIC GENERATING INSTALLATION.**—This comprises three sets of B. & W. 428MTHK-45 type four cycle, single acting, solid injection Diesel engine with four cylinders of 280 mm. bore and 450 mm. stroke, each developing 210 b.h.p. at 300 r.p.m. fitted with a two stage air compressor of 240 c.m. per hour at 25 kgs. per sq. cm., and 135 kw—225-volt D.C. compound wound dynamo.

**PROPELLER.**—This is of four bladed, manganese-bronze, detachable aerofoil type with a diameter of 17-ft., mean pitch 14-ft. 6-in., developed area 83.5 sq. ft., projected area 73.9 sq. ft. and a pitch ratio of 0.8529.

## Trial Results of the "Kirishima Maru"

Various trials of the m.v. *Kirishima Maru* were carried out on the Inland Sea, and in the official trial a mean speed of 18.029 knots was attained with a mean output of 6,971 b.h.p. at 104.25 r.p.m. In the fuel consumption trial, the consumption of the main engine only and that including auxiliary machinery were recorded as 166 grams and 183 grams per b.h.p. per hour, respectively, at a mean speed of 16.897 knots.

The details of the trial results of the *Kirishima Maru* are given in the following tables and graph attached, those of the *Katsuragi Maru* being not available:—

### (a) Progressive Trial :

Date	24th and 25th June, 1931		
Weather	...	...	24th, Rainy ; 25th, cloudy.
Sea	...	...	smooth
Draught, mean...	...	...	18-ft. 4½-in.
Trim by stern	...	...	11-in.
Displacement	...	...	946.5 tons.

V.	R.P.M.	B.H.P.	D <sup>2</sup> V3	B.H.P.	E.H.P./B.H.P.
12.984	68	1,922		510	0.926
14.578	79	3,203		433	0.802
15.749	85.375	4,224		414	0.805
16.465	92	5,390		371	0.764
16.802	95	5,881		361	0.768
17.154	97.5	6,378		356	0.787
17.259	100.25	7,112		324	0.727

## (b) Official Trial (c) Fuel Consumption Trial

Date	June 29, 1931	June 27, 1931
Weather	... ... cloudy	cloudy.
Sea	... ... smooth	smooth
Draught, mean	... ... 13-ft. 6½-in.	18-ft. 4½-in.
Trim by stern	... ... 2-ft. 11-in.	10½-in.
Displacement	... ... 6,677.1 tons	9,470.5 tons
Speed	... ... 18.029 knots	16.897 knots
R.P.M.	... ... 104.25	96.75
B.H.P.	... ... 6,971	6,130
D <sub>2</sub> V <sub>3</sub> /B.H.P.	... ... 305	352
E.H.P./B.H.P.	... ... 0.708	0.759

## Fuel consumption:—

Including auxiliary machinery ... ... 183 grms/B.H.P./hr.  
 Main engine only ... ... 166 „ „ „  
 The general design of both the *Kirishima Maru* and *Katsuragi Maru* was prepared by Mr. M. Watase, the owners' superintendent naval architect, and the vessels have been completed under his careful inspection to the entire satisfaction of the owners and builders.

**AUXILIARY MACHINERY.**—Apart from those mentioned above, the engine room auxiliaries and deck machinery areas shewn in the following table:—

## ENGINE AND BOILER ROOM AUX. AND DECK MACHINERY

Name	Type	No. of Set	Volt	Capacity	Motor H.P.	W. Cyl. dia. x st. or d. of imp.	Dia. of Suc x Dis	R.P.M. of Motor	No. of Dbl. St. or R.P.M. Pump	Head or Press	Maker
Emergency air compressor	Hand driven 2 stage	1	—	30 liter/m.	Hand	h.p. 1½" x 1.p. 2½" x st. 5"	—	—	90	25 kg/cm <sup>2</sup>	Tama
Emergency Diesel dynamo	4 Cyl. 4 Cycle	1	225	20 kw.	Diesel h.p. 36	—	—	600	600	—	Koerting new type 4-sr-14
Main cooling w. pump	Centr.	2	220	275 T/H	35 h.p.	360 mm.	8" x 8"	1000	1000	50-ft.	Tama
Main lub. oil pump	Rotary	2	„	125 T/H	„	—	8" x 7"	450	450	110-ft.	„
Bilge and San. pump	3 throw plunger	1	„	b.2 x 20 T/H	13 h.p.	6½" x 9"	b. 3"	1000	100	—	Ishii Tekko Jo
Gen. service pump	Vert. 3 stage centr.	1	„	s. 1 x 20 „	30 kw.	3st. x 12½"	7" x 7"	1200	1200	70 m.	U.D.C.
Combined cargo oil and ballast pump	Duplex dbl. Act.	1	„	each 150 T/H	35 kw.	10" x 10"	8" x 8"	„	65	120-ft.	U.D.C.
Fuel oil trans. pump	Gear wheel	2	„	30 T/H	15 h.p.	—	3½" x 3½"	1000	396	110-ft.	Tama
Fuel oil service pump	„	2	„	6 M <sup>3</sup> /H	3.5 kw.	—	2" x 2"	1200	1200	30 m.	U.D.C.
Fresh water pump	2 throw plunger	1	„	10 M <sup>3</sup> /H	„	4½" x 6"	2½" x 2½"	„	70	25 m.	„
Lub. service pump	Gear wheel	1	„	6 T/H	—	—	2" x 2"	—	1200	30 m.	—
Autogrigor cooling pump	Centr.	1	„	—	1.4 h.p.	—	30 x 30 mm.	2800	2800	—	Escher Wyss Co.
Autofrigor	A 2603 d.e. convator	2	130	—	1.3 h.p.	—	—	—	700	—	„
Fuel oil purifier	Sharples	2	220	400-450 U.G./H	3 h.p.	—	—	3450	—	—	Sharples Speciality
Lub. oil purifier	„	2	„	350-400 U.G./H.	„	—	—	„	—	—	„
E. Room exhaust fan	U.D.C. type	2	„	8100 cu. f./m.	8 kw.	20½" d. x 9½" b.	16" dia.	1300	1300	3-in.	U.D.C.
Donkey feed pump	Weirs'	2	100 #/D	3 T/H	—	5" x 3½" x 6"	2" x 1½"	—	50	100 #/D	„
Fuel oil bur. fan	U.D.C. type	1	220	21 m <sup>3</sup> /m.	4.5 kw.	—	20"	2500-2700	2500-2700	14-in.	„
Mach. shop motor	d.e. shunt	1	„	—	1.0 kw.	—	—	1500	—	—	Meidensha
Valve Grinder	U.D.C. type	1	„	—	0.6 kw.	—	—	1000	—	—	U.D.C.
Name	Type	No. of Set	W. Press	Capacity	C. S. or H. S.	B. T. P. or Size	Tube		R.P.M. of Motor	Motor H.P.	Maker
Exhaust boiler	Uruga thimble	1	100 #/D	4000 #/H	600 #	sh.d. 6'-0" x 9'-1½" c.e.d. 5'-0"	3½" x #6	676	—	—	U.D.C.
Aux. condenser	Cylind. non-vac.	1	—	—	150 #	—	1" x #18	—	—	—	„
Lub. oil cooler	Cylind.	1	—	—	1,400 #	6'-0½" dia. 2'-8"	ex. dia. 7/16"	2043	—	—	Tama
Starting air reservoir	Cylind. riveted	2	25 kg./m <sup>2</sup>	15 cb. m.	—	d.6'-2" x h.20'-1½"	sh.t. 1½"	—	—	—	U.D.C.
Aux. starting air reservoir	Solid tube	1	„	300 L.	—	D450 x 1940	sh.t. 13	—	—	—	Tama
Overhead crane	Hoisting Travelling	2	—	4kt. x 4m. Speed 20 mm.	max. lift	6 m.	—	—	1150	5	Gas Denki
		1	—	—	—	—	—	—	750	3 kw.	Meidensha
Name	Type	No. of Set	Volt	Capacity	Motor H.P.	Motor R.P.M.	Chain or wire speed	End Drum	Chain or Wire Size	Heavy Cargo Gear	Maker
Steering gear	A.E.G. Leonard	1	180	T.M. 67-ft. ton	19 kw.	430	H. over to H. 80° 30 sec.	—	rudder stock 11½"	—	U.D.C.
Windlass	Uraga elect.	1	220	—	62"	1000	30-ft./m.	10T. x 100-ft./m.	2½"	—	„
Winch	Mitsubishi	13	„	3T	33 h.p.	440-1650	120-ft./m.	—	—	1 set 10T. 35-ft. drum	Mitsubishi
Winch	„	8	„	5T	46 h.p.	350-1400	100-ft./m.	—	—	1 set 10T. 50-ft. drum	„
Poop winch	„	1	„	5T	57 h.p.	420-1450	100-ft.	10T. x 57-ft./m.	—	—	„
Steering motor generator	A.E.G. Leonard	1	„	—	20.7 kw.	1250	—	—	—	—	A. E. G.

# The Training Diesel Tug "Yayoi Maru"

Tokyo Higher Navigation College  
Craft Has Mitsubishi-Vickers  
Trunk Piston Engine

By Our Special Correspondent

THE remarkable development of modern marine Diesel engines made it essential for students of navigation colleges to learn thoroughly the handling of Diesel engines and the manoeuvring of motorships as well as the traditional arts of navigation and seamanship.

The Japanese Ministry of Education ordered sometime ago from the Kawasaki Dockyard Co., Ltd., two 2,400 ton training ships of barque type equipped with two 600 b.h.p. Diesel auxiliary engines for the training of cadets from eleven navigation schools located at various parts of Japan. The vessels were named the *Nippon Maru* and *Kaiwo Maru*, of which a full description was given in *The Far Eastern Review* of October 1931.

Another training motorship *Hakuyo Maru*\* of 1,328 gross tons equipped with two 700 b.h.p. Diesel engines was also built for the Imperial Fisheries Institute, Tokyo.

The special Diesel-tug *Yayoi Maru* was built for the Tokyo Higher Navigation College for practising the handling of Diesel engines by the students under the characteristically frequent manoeuvring of the tug boat and also to carry out various experiments and tests relating to the actual performance of the Diesel engine.

The principal particulars of the boat are as follows:—

Length between perpendiculars	...	60-ft. 0-in.
Breadth	...	14-ft. 0-in.
Depth	...	8-ft. 0-in.
Draught full load	...	6-ft. 0-in.



The "Yayoi Maru" in the Basin of the Tokyo Higher Navigation College

Gross tonnage	...	...	...	44.5 tons.
Fuel oil capacity	...	...	...	4.0 tons.
Fresh water	...	...	...	1.0 ton.
Main engine:—				

Mitsubishi-Vickers Trunk-Piston Diesel, Type RZ6.

B.H.P.	...	190
R.P.M.	...	380

Speed	...	...	9.8 knots.
Propeller	...	...	single.

The boat was designed for the coastal service, but it being also necessary to go up the River Sumida, the height of the permanent structure was made less than 15 feet above the light load water line, and the mast can be brought down under the bridges.

On a voyage of about 41 hours from Kobe to the Harbor of Tokyo the fuel consumption was about 1,880 kgs. Comparing this with a similar steam installation, the latter will require about 7,260 kgs. of coal including the consumption at port, so that it would be necessary to have a coal bunker capacity of some 10 tons. The airless injection system is also advantageous in ships of this type,

as it simplifies the construction of engine, and saves watch hands due to the absence of tedious injection air compressors.

The engine of this boat was specially designed to carry on various experiments by the students under the instruction of professors, and its particulars are as follows:—

Type—Mitsubishi-Vickers airless-injection, four-cycle, trunk-piston Diesel.

No. of cylinders	6.	
Bore	...	225 mm.
Stroke	...	350 mm.
R.P.M.	...	380
Piston speed	...	266 meters per min.
Full power	...	190 b.h.p.
Overload power	...	210 b.h.p.
Official trial speed	...	9.8 knots.
Over-all length of engine	...	3.134 meters.
Height	...	1.89 "
Weight of main engine, only	...	8,734 kgs.
Total machinery weight, including bearings, shaft and propeller	...	17,967 kgs.

This type of engines has been developed from the original Vickers engines after various improvements made by the Mitsubishi Kobe works, and the main reasons the Tokyo Higher Navigation College



Main Engine of the "Yayoi Maru," 190 b.h.p., RZ 6 Type, Mitsubishi-Vickers

\*See *The Far Eastern Review*, February, 1932.

adopted this engine may be summarized as follows :—

1. It being a light engine able to navigate shallow waters with a draught less than 5-ft. 6-ins., as the main engine weight per b.h.p. is only 46 kgs.
2. It being able to produce a necessary large power for experiments and towing.
3. It being of a simple and robust construction and suitable to be handled by inexperienced students.
4. It being economical in fuel consumption, which is less than 190 grams per b.h.p. per hour.
5. It being purely a home-made engine and of airless injection type.

The general construction being easily seen from the photograph reproduced, only special points of the construction and experimental equipment will be herewith explained.

Six cylinders are fitted to a rectangular common frame, while a high pressure fuel pump, a cooling water pump, a bilge pump and a lubricating oil pump, all at the forward end of the engine, are driven by means of Mitsubishi patent eccentric levers of the main engine. Thus, all auxiliaries are directly coupled to the main engine and the handling is extremely simple.

The cooling water pump is of a single acting reciprocating type with a piston diameter of 105 mm., a stroke 36 mm. and a delivery capacity of 26.9 litres per min. This pump supplies cooling water to the cylinders, cylinder covers, exhaust valve boxes, exhaust manifolds, etc., and the quantity of water circulated is less than six gallons per b.h.p. per hour, while the temperature difference of water at the delivery and inlet is kept within 25 degrees C. If the temperature of cooling water is too low due to an excess quantity, a part of high temperature delivery water is returned to the suction end. In cold weather, delivery cooling water of the auxiliary semi-Diesel engine can be utilized for warming up the main engine cylinders. Hand pumps are also provided parallel to these pumps and can be necessarily operated before starting and after stopping the main engine.

The mean top clearance of the cylinders is regulated to be 7 mm. and its corresponding volume is 1,165 cub. cm. at a compression of 36 kgs. per sq. cm., while the maximum combustion pressure is regulated to be 46 kgs. per sq. cm.

The high pressure fuel oil pump has four pistons giving a pressure of about 350 kgs. per sq. cm. to fuel oil, which is first delivered to a common main and then to fuel valves of cylinders through branch pipes. The characteristics of the Mitsubishi airless injection system are of the provision of this common fuel oil main and that

The Diesel Tug "Kasamatsu Maru" on Trial

the fuel valves are mechanically regulated by cams ; consequently the fuel oil pressure can be suitably regulated in accordance with the load. An operating handle is provided to adjust the lift and timing of the fuel valves and also a fuel controlling handle serves to regulate the fuel pump capacity.

In the *Yayoi Maru*'s engine, the fuel oil pressure and loads are fixed as follows :—

Load	Oil pressure, kgs. per sq. cm.					
11/10	...	...	...	...	...	360
10/10	...	...	...	...	...	350
7.5/10	...	...	...	...	...	325
5/10	...	...	...	...	...	300
2.5/10	...	...	...	...	...	250

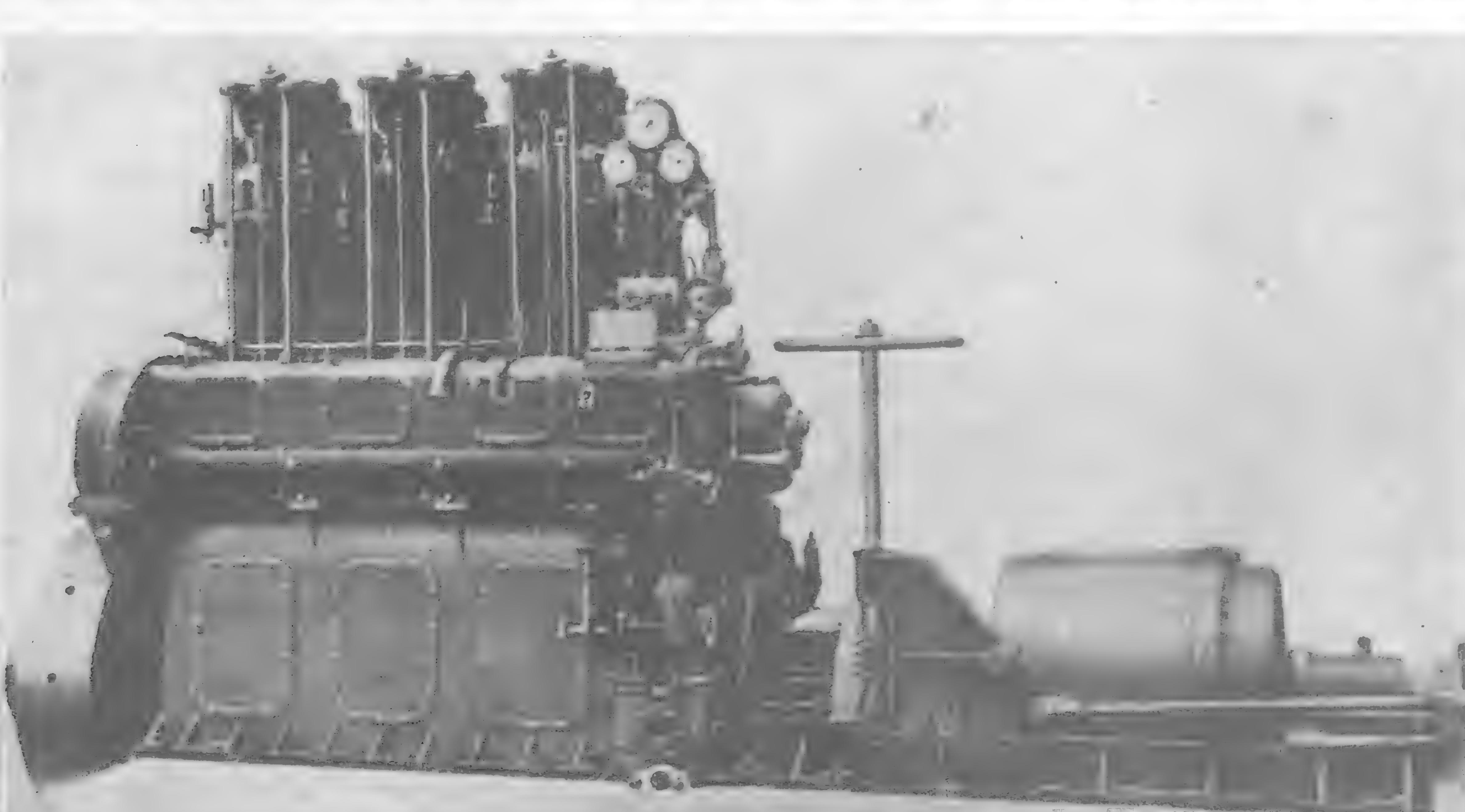
The diameter of axial holes of fuel valve nozzles is 13.5/1,000 inch, fuel oil is injected at an angle of 72 degrees to the center line of cylinder. It is so designed that the injection commences at about 10 degrees before the upper dead point and closes at about 20 degrees after the upper dead point. The lift of valves is 0.825 cm. at full power.

As to fuel oil, both heavy and light oil is usable, the latter being only for starting the engine in cold weather and also for cleaning up the fuel oil system before stopping the engine, its application is infrequent.

On the shop tests, the fuel consumption was 176.3 grams per b.h.p. per hour and the heat efficiency 34.4 per cent, while on the sea trials 177.5 grams and 34.2 per cent were recorded. Fuel used was Borneo heavy oil of a specific gravity 0.9435 at 15 degrees Cent. and a heat value of 10,455 calories.

As regards the equipment for experiments, besides indicator outfits, pressure and temperature measuring apparatus, etc., a Michell's thrust indicator, a Hopkinson's thring torsionmeter, a Lehmann and Michell's torsograph, etc., are provided. By means of this equipment, the relation of i.h.p., s.h.p. of the propelling machinery and the propeller thrust at various displacements, speeds, and the resistance of ship will be investigated. Also, the measurement for the engine efficiency and vibration together with the dynamical efficiency of all moving parts will be conveniently carried out.

The auxiliary machinery is only one set of 12 b.h.p. Hamworth semi-Diesel engine with a starting air compressor, which supplies compressed air to two



Engine of the "Kasamatsu Maru," 150 b.h.p., RB 3 Type, Mitsubishi-Vickers



(Continued on page 199)

# Largest Four-Cycle, Single-Acting, Solid Injection Super-Charged Diesel Engine

Mitsui—B. & W. Power Plant is Developed by the Mitsui Tama Works

By Y. TAJI, M.I.N.A., M.I. Mar.E., etc.

THE "speed epoch" has necessitated the development of high-powered engines on land, sea and in the air. Particularly, the recent progress in the design and construction of marine Diesel engines of various types has been extremely remarkable.

Among new types of high-powered Diesel engines introduced in the last year are the Sulzer double-acting two-stroke design, the Burmeister and Wain single-acting two-stroke engine, the M.A.N. two-stroke double-acting airless-injection engine, etc., whilst the new Mitsui-B. & W. 6,000 b.h.p. single-acting airless-injection supercharged engine built by the Mitsui Tama Works is the largest unit ever built in the world for a single-acting four-cycle type, since it has been generally considered that a double acting engine is more suitable for such a large output by a single unit.

It would be, however, desirable to have single-acting engines for ordinary cargo vessels in view of the simplicity of mechanism and the easiness of handling, whenever the required output is available. The Mitsui Tama Works succeeded in turning out such an engine of unprecedented type by adopting a special high pressure charging system of their own design, and installed it in the new express cargo motorship *Katsuragi Maru* completed last November at the Uraga Dockyard for the Orient-American service of the Kokusai Kisen Kaisha, Ltd.

The origin of the enterprise of the Mitsui Works for super-charging the B. & W. type four-cycle engine at a high pressure dates back to 1929, when the mean indicated pressure was raised to 8.5—9.5 kgs. per sq. cm. from the usual value of 7.0—7.5 kgs. per sq. cm. and the mean effective pressure was raised up to 7.4—8.1 kgs. per sq. cm. from about 6 kgs. per sq. cm. The results gave confidence to the builders in developing a single-acting four-cycle engine with an output of 600 b.h.p. per cylinder. When an order for a 6,000 b.h.p. engine was placed with them by the Kokusai Kisen Kaisha, Ltd., for a new high speed cargo ship, they successfully produced the super-charged engine of the required output and established a new record for the largest single-acting four-cycle unit in the world.

The leading characteristics of this engine are as follows:—

Type:—Mitsui—B. & W. four-cycle, single-acting, airless-injection, pressure-charged, cross-head type, D.E. 1074-TF-150.

No. of cylinders	10
Diameter ,,	740 mm.
Length of stroke	1,500 mm.
I.H.P. (normal load)	about 7,000
B.H.P. ( , , , )	6,000
R.P.M. ( , , , )	115
Total engine weight, including shafting and bearings	465 tons
Height over all	9,200 mm.
Height from bottom of bed plate to top of cylinder cover	7,620 mm.
Width of bed plate	3,800 mm.
Length over all	17,680 mm.

The engine comprises two parts of fore and aft groups, each consisting of five cylinders; and between them are a cam shaft and roller chain gear for operating super-charging blowers. The Brown's manoeuvring gear is fitted at the port side of the engine casing, whilst on the starboard side are two sets of super-charging blowers of Roots' type enclosed in two casings, installed on a small platform and driven by the main crank shaft through chain gearing. The general arrangement will be seen from Figs. 1 and 2.

## General Construction

*Cylinders and covers* are of pearlit cast iron resisting wear and heat stresses. The covers are rectangular in shape, each having openings for a fuel valve, a super-charge valve, an exhaust valve and a starting valve, and are connected firmly with strong flanges to the cylinders which are cooled by sea water.

*Pistons* are also of pearlit cast iron fitted with a number of cast iron rings and are cooled internally by lubricating oil.

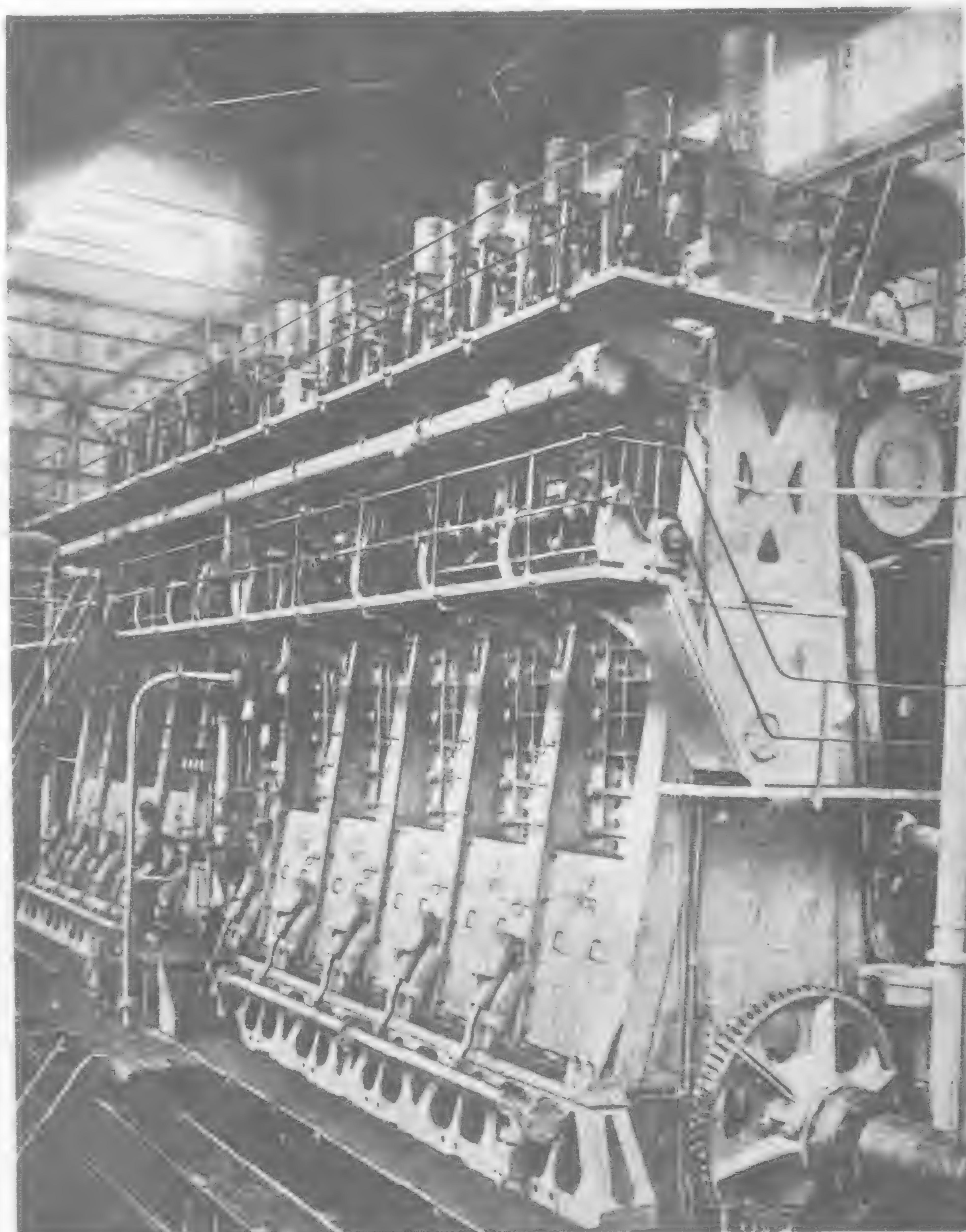


Fig. 1

Piston rods, connecting rods, crank shafts, etc. Are of best Siemens-Martin steel and are constructed as is in the usual practice. The crank shaft is of shrunk-in type comprising two sections, connected by flanges at the middle part of the engine. The crank angle being 72 degrees with suitable counter weights for balancing, and also special precaution was taken in design for torsional vibration.

Frames and bed plates are of cast iron. The A-shaped frames support cylinders and covers through H-shaped intermediate columns while the tensile stress due to combustion pressure is transmitted to the bed plate through long stay bolts as is usual in this type of engines. The frame and bed plate are so designed as to have suitable numbers of the proper vibration, whilst the bottom of bed plate is utilized for lubricating oil swamps.

Valves and valve gears are constructed under special precaution including the feed injection system and super-charging system. Valves are cooled by sea water and valve seats are of special heat-resisting steel.

Starting and manoeuvring of the engine are effected by compressed air at 25 kgs. per sq. cm. following the order of operation and are absolutely fool proof. For manoeuvring, Brown gear is used, and for the super-charging Roots' blowers are used, as described before. The details will be seen from Figs. 3 and 4.

### Special Features

Specialities of this engine are in the airless injection and the high pressure charging.

Following the recent trend of adopting the solid injection system to large units, the Mitsui Tama Works have already turned out with success fifteen engines of this type with the total output of 15,150 b.h.p., since 1928, and in October 1930, m.s. *Shohei Maru*'s main engine with a cylinder diameter of 740 mm. and a stroke of 1,500 mm. was built by this firm, which may be considered the largest cylinder size for the airless injection type, and now this was followed by the super-charged engine of the m.s. *Katsuragi Maru*.

The airless injection system of this latest engine comprises primary low pressure pumps (or pumping-up pumps), primary fuel oil filters, high pressure fuel oil pumps, h.p. fuel oil filters and fuel valves. The general arrangement is shown in Fig. 4.

Fuel oil enters first to the primary fuel oil pumps from fuel oil tanks under gravity, and after acquiring a pressure of about 2.5 atms. is delivered to h.p. fuel oil pumps fitted to each cylinder.

As shown in Fig. 5, the h.p. fuel oil pump comprises a piston P, a slide valve C for adjusting fuel quantity, a suction valve S, a fuel oil passage L to fuel valve, a fuel oil passage K to slide valve, an escape R for excess fuel oil and an arm F for moving the slide valve, this arm being connected to a control handle and a governor.

The piston and slide valve are operated by the same cam, whilst the suction stroke for oil is effected by a spring T and the delivery stroke by the cam. The effective delivery stroke is adjusted in accordance with load and the quantity of fuel delivered can be altered, this being effected by means of turning the slide valve in order to alter the cut-off of fuel oil whilst excess fuel will return to the fuel oil tank through the passage R. The cam is so designed as to operate the piston at a constant speed, whilst a special profile is adopted to prevent the noise and wear as far as possible. The angle of advance of cam is fixed at eight degrees. Fuel oil is delivered

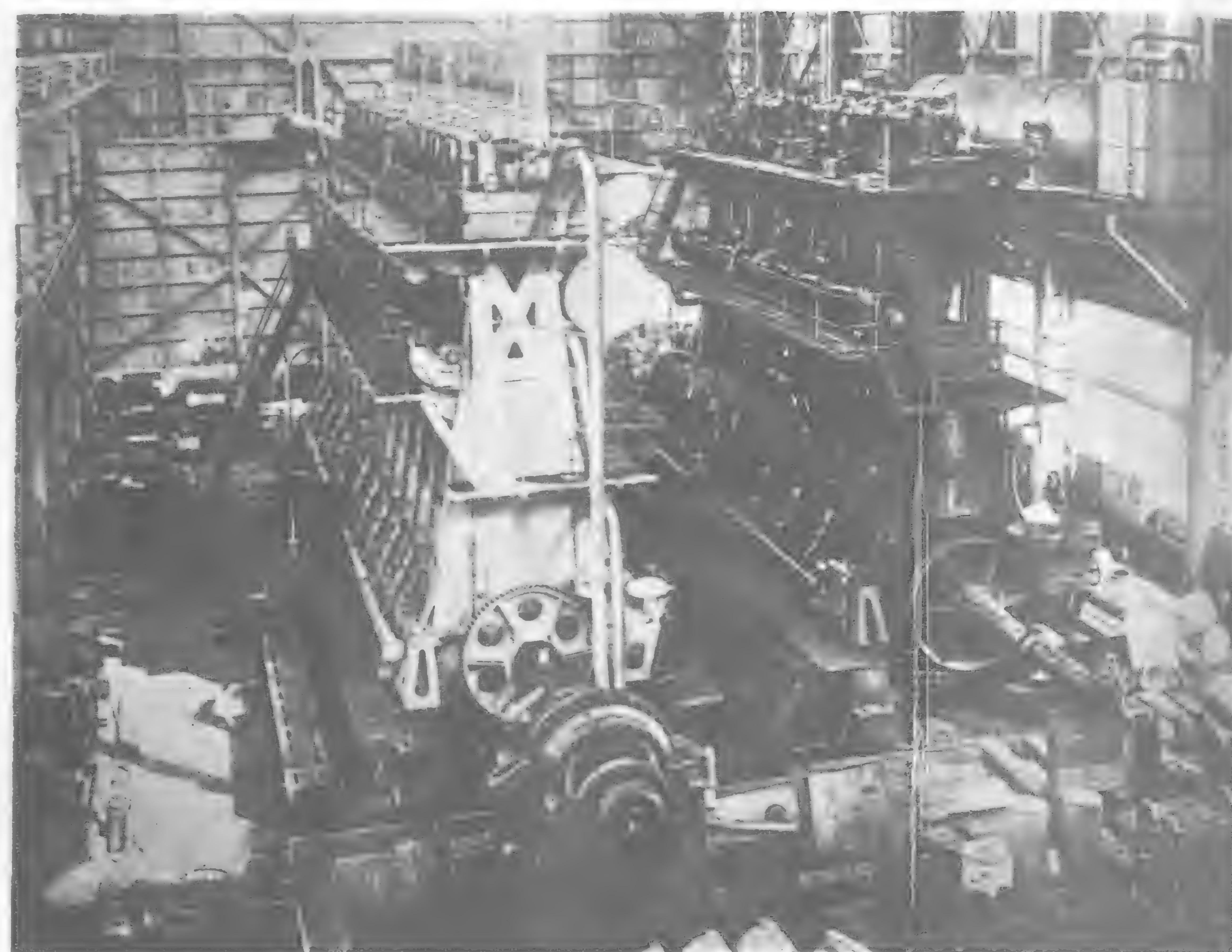


Fig. 2

to the fuel valve through h.p. fuel oil filter at a pressure of 350-500 kgs. per sq. cm. by h.p. fuel oil pumps.

As shown in Fig. 6, the fuel valve comprises a filter casing R, filter S, clearance liner T, atomizer H, valve spindle F, valve spindle liner E, bell spring N, adjusting screw M for the spring, washer O, pivot P, valve body A, valve cage B and air plug D.

The filter consists of the outer and inner bodies of conical shapes with such a small clearance as 0.07 mm. between them, which removes all minute solid impurities and prevents choking of atomizer nozzles. Fuel oil entering the fuel oil valve through this filter and lifting the spindle F up, is finally injected into the cylinder through atomizer nozzles G. The spindle F is made hollow to minimize the weight. A number of bell springs N give a necessary load to the spindle F which is easily adjusted by a screw nut M. Atomizer nozzles are six in number, each having a diameter of 0.9 mm., and their length, diameter and direction are fixed by tests in order to make the most suitable atomising action in accordance with the shape of combustion chamber.

The adjustment of the airless injection is effected by (1) the timing, (2) the pressure of fuel oil and (3) the amount of fuel oil supplied. In this engine, these are independently carried out, i.e. the timing by changing the relative position of rollers against cam, the fuel oil pressure by changing the load of spring over the fuel valve, and lastly the fuel quantity by adjusting the position of the slide valve.

As another speciality of the Mitsui-B. & W. fuel injection system, it may be pointed out that pistons and slide valves of the fuel pumps are packingless. The builders stick on the independent arrangement of one fuel pump to each cylinder and to fit it as near as possible to the fuel valve. This, they believe, can annihilate the inconvenience of adjustment due to the irregularity of the fuel supply through piping.

### H.P. Super-charging System

The recent development of super-charged internal combustion engines has been very remarkable. It appears that the original idea of super-charging based upon the substantial combustion of fuel by inducing ample air at a higher pressure, has been now apparently altered in meaning as to reduce the mean temperature in cylinders at a higher mean indicated pressure and to prevent trouble in materials due to the high temperature of combustion, particularly

in cylinder covers, pistons and fuel valves in case of running continuously for a long period. In this sense, the cause and effect appear to affect each other for the production of a higher power.

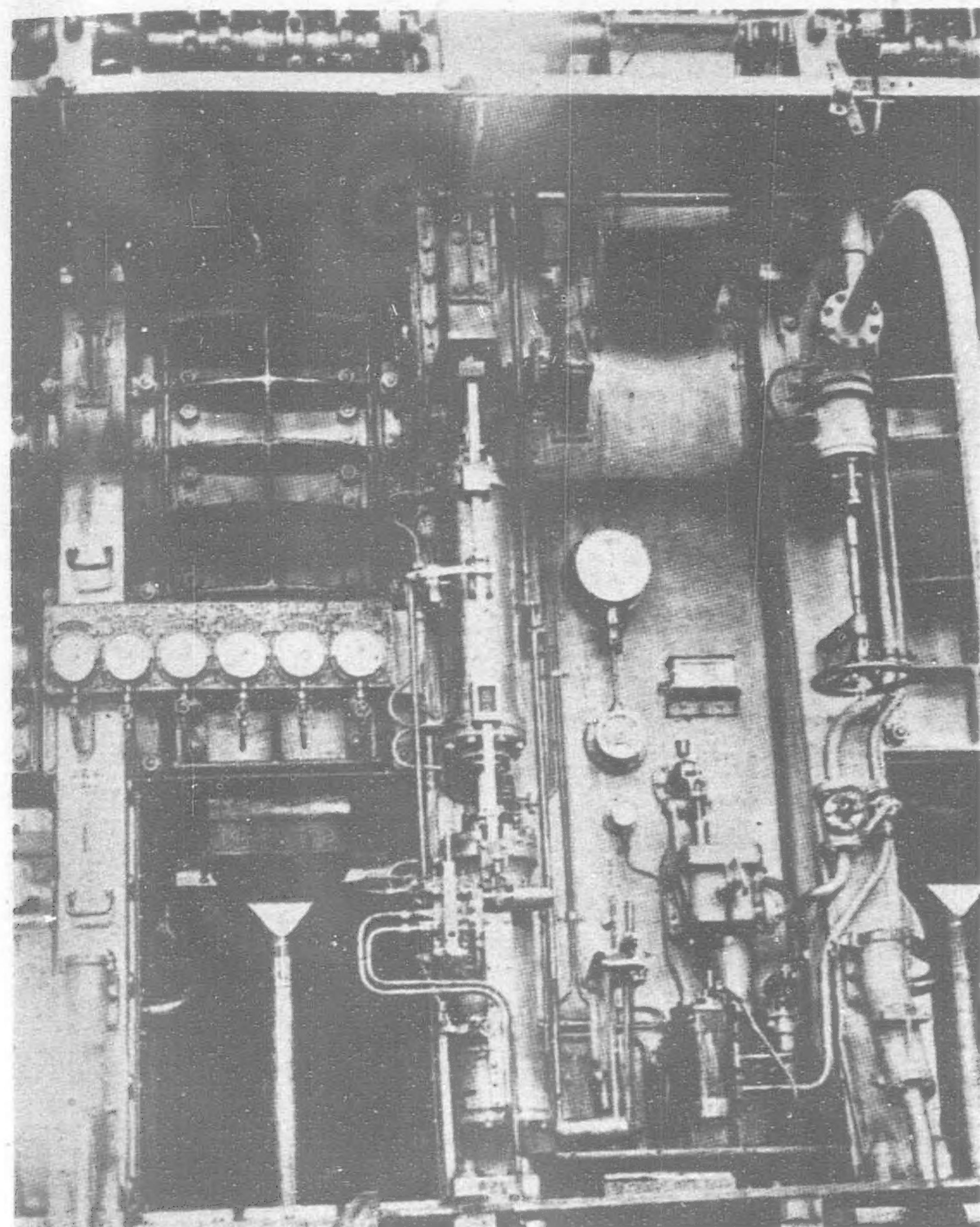


Fig. 3

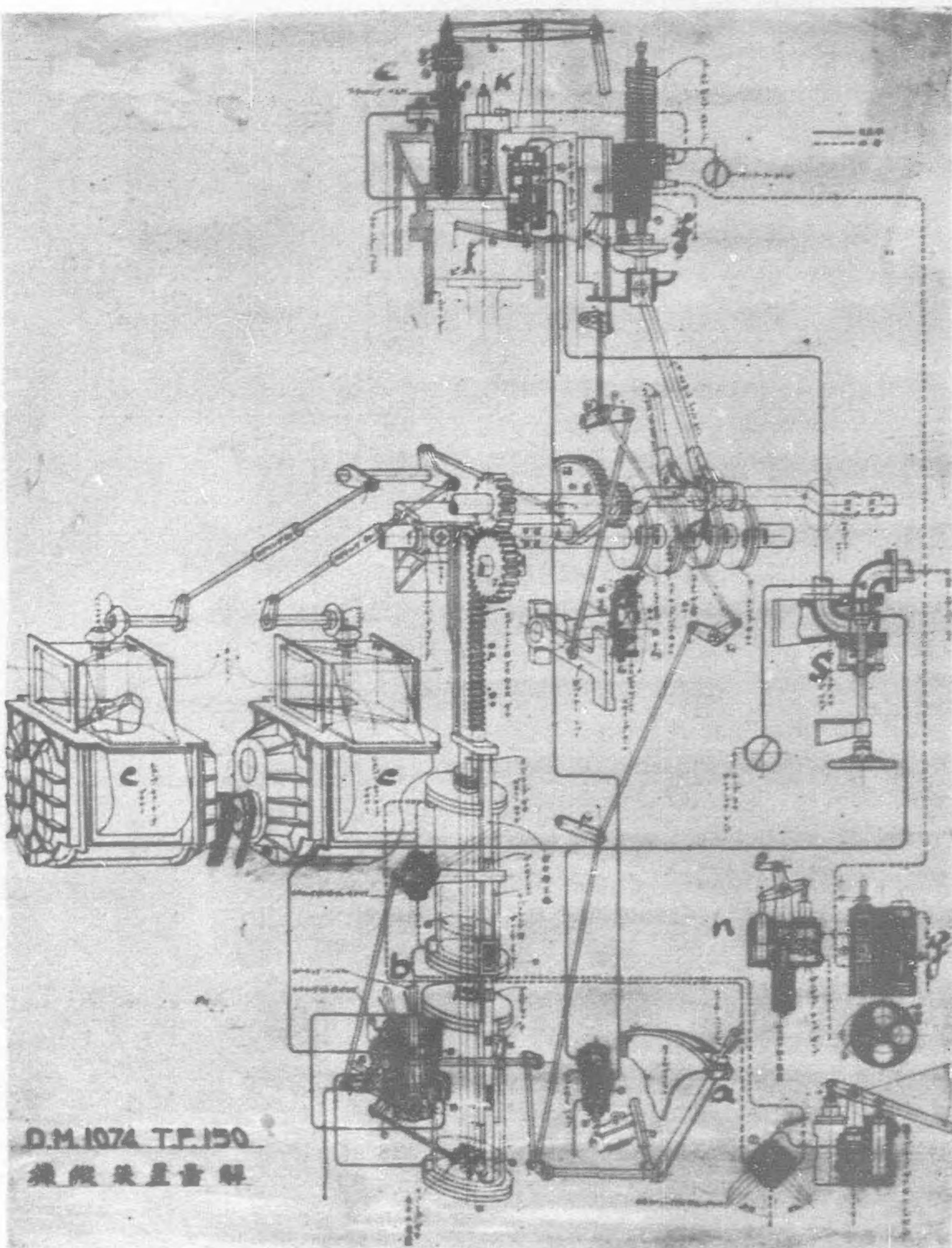


Fig. 4

(a) Control valve	(e) Starting valve	(s) Starting air stop valve
(b) Reversing handle	(f) Fuel pump	(g) Fuel oil filter
(c) Super-charge blowers	(k) Fuel valve	(h) Pumping-up pump
(d) Cams	(p) Piston	

## VALVE TIMING

### FOR SUPERCHARGE WITH EXHAUST TURBINE

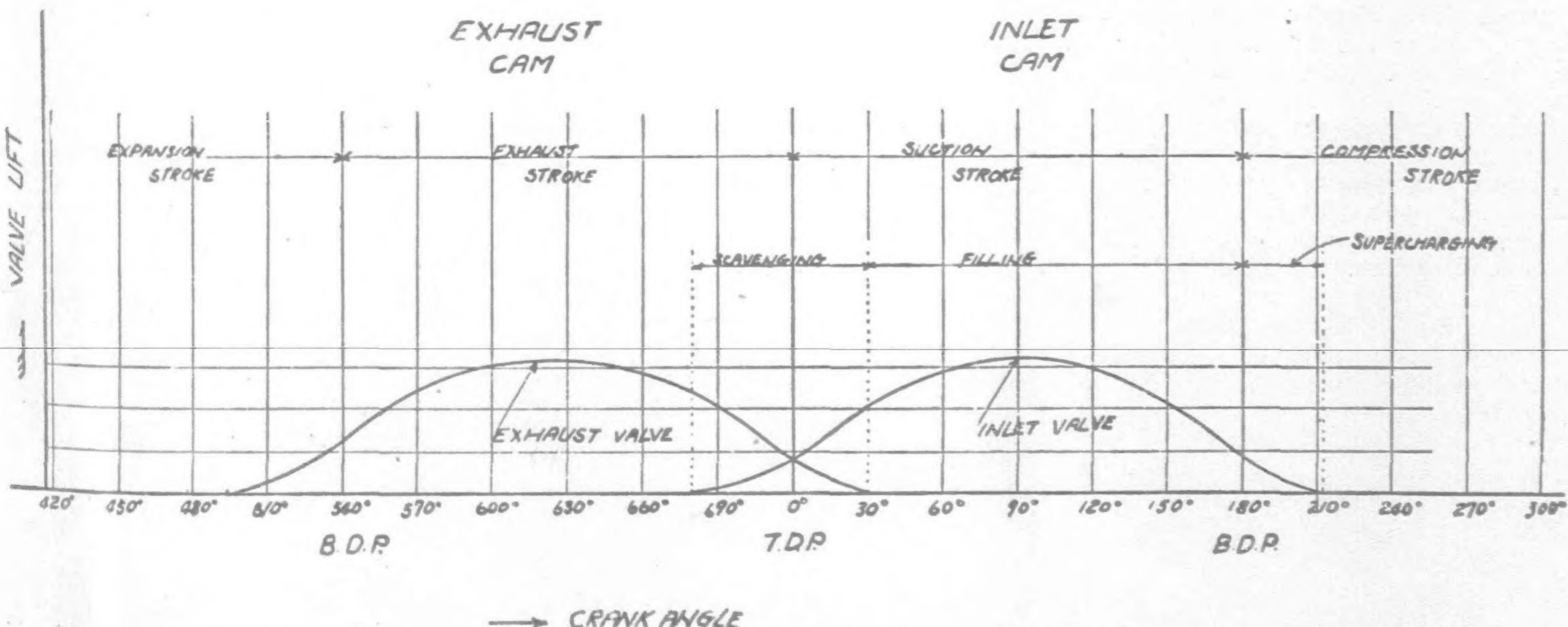


Fig. 7

In the usual super-charging system, the operation embodies (1) the scavenging, (2) the filling and (3) the super-charging, as shown in Fig. 7. Thus, the suction air valve is open at 30—40 degrees in advance to the end of exhausting stroke, and prior to the closing of the exhaust valve, the super-charging air is forced into a small cylinder volume at the top dead point and drives out remaining exhaust gas in the clearance through the exhaust valve, and simultaneously cools the cylinder cover and piston as the result of the through scavenging. In accordance with the downward motion of the piston, supercharge air fills the cylinder until it reaches the bottom dead point, whence the air valve being still open after the dead point, the super-charging air is supplied until the air pressure in the cylinder is raised to the predetermined value. Therefore, in the ordinary super-charging system, pressure-air is used for all of these three operations.

In the Mitsui—B. & W. super-charging system, unlike other systems, pressure air is not used for the filling, but atmospheric air is drawn in as in a non-super-charged engine, whilst pressure-air is only utilized for the scavenging and super-charging. The effect is, however, similar to that of the ordinary super-charging system, but the quantity of super-charged air is considerably less with the consequent reduction of capacity and power of super-charging blowers, enabling the main engine to drive the blowers directly. The overall efficiency is not only superior to that of super-charging by exhaust turbines, but also it saves the complication of exhaust piping and suction air piping, in a large unit.

In order to materialize the advantages of this system, a special super-charge valve was designed. As shown in Figs. 8 and 9, this super-charging valve comprises a valve cage O, valve spindle M, super-charge sluice valve A, liner D, suction opening to atmosphere H, opening to super-charge blower G, atmospheric port (slits) C for free air suction and pressure port (slits) B for pressure-air suction.

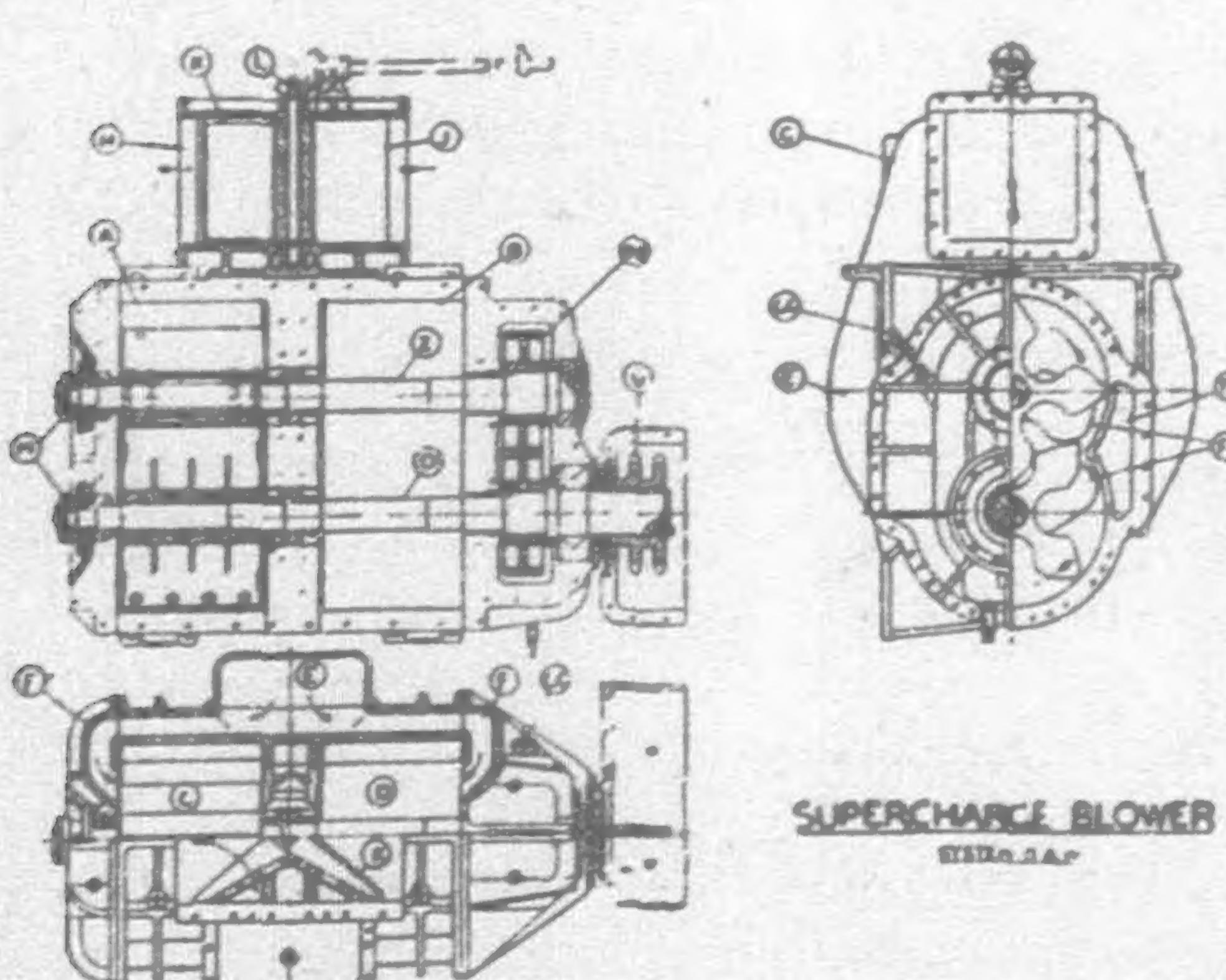


Fig. 11 and 12

PORT OPENING AND LIFT VALVE

1074 TF-150  
VALVE TIMING FOR SUPERCHARGE  
MITSUI B & W SYSTEM

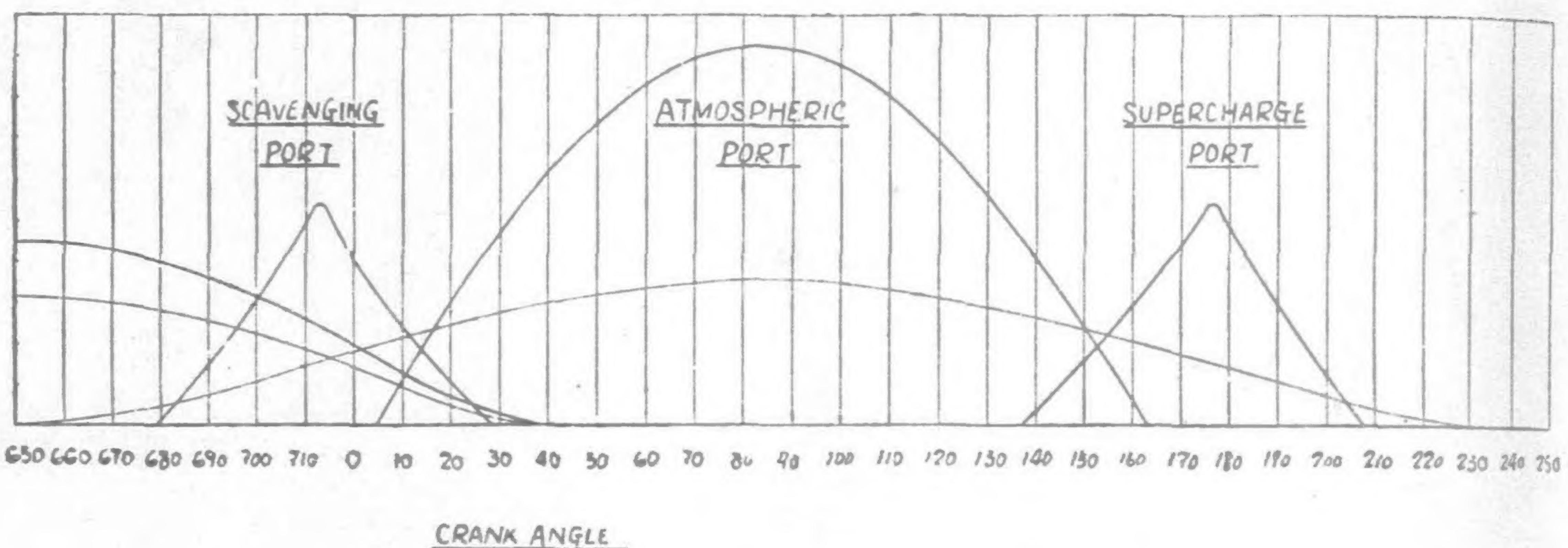


Fig. 10

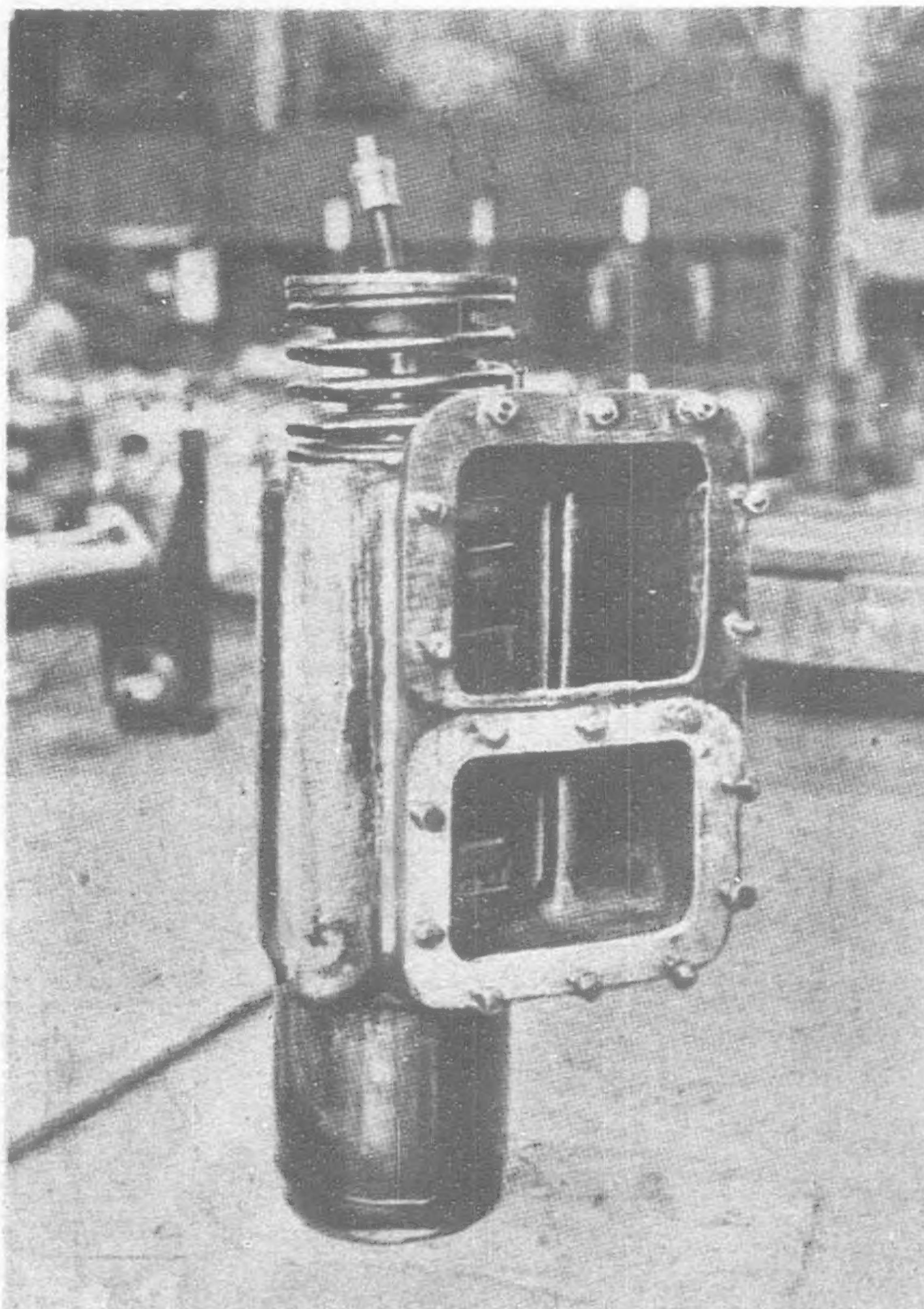
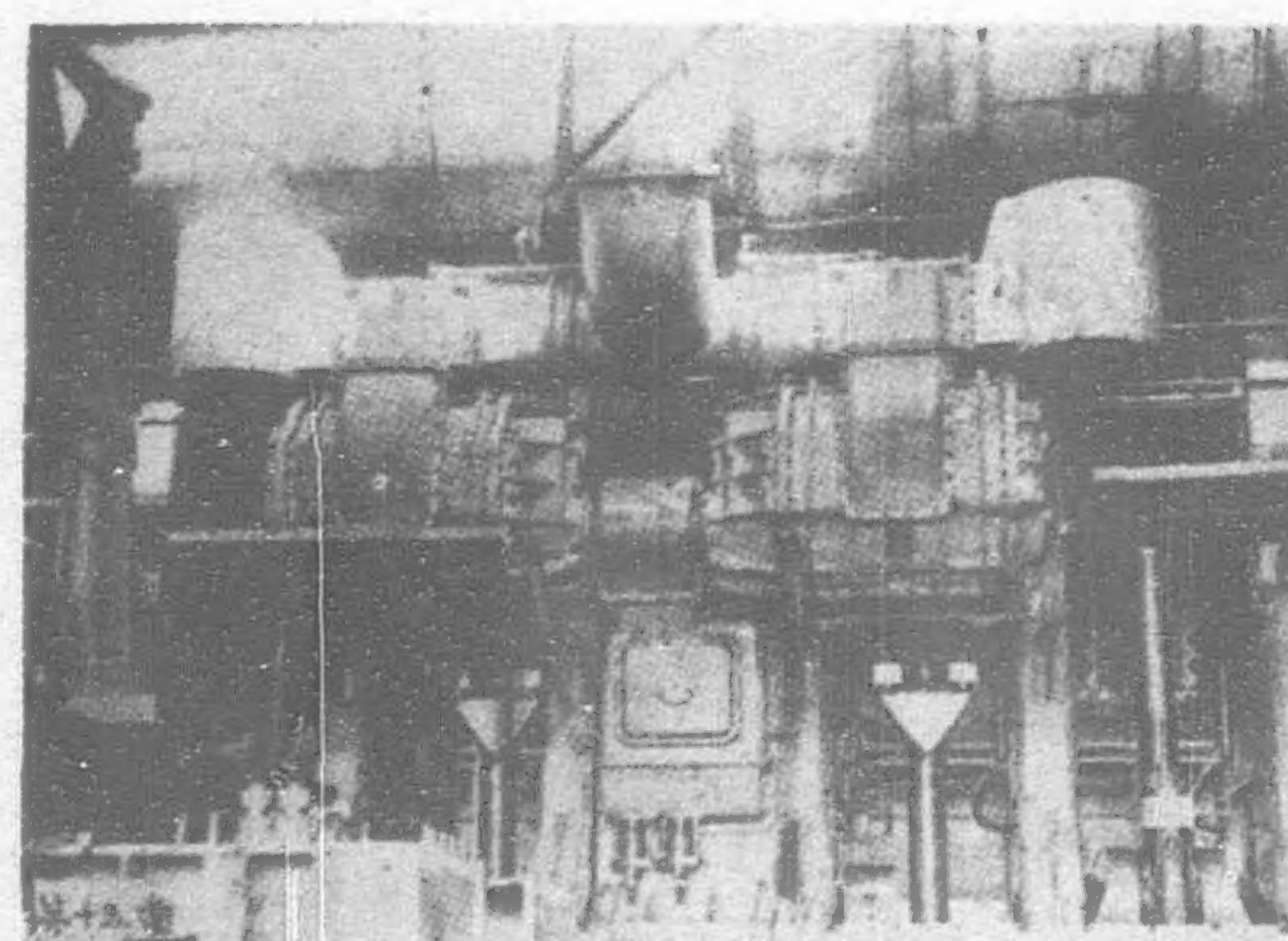


Fig. 9



The timing of the super-charge valve is diagrammatically shown in Fig. 10. When M begins to open, by the action of cam, at about 40 degrees in advance to the top dead point, A and M co-operating together, B is open to introduce the super-charge air into the cylinder. At this point, the exhaust valve being not yet closed, the scavenging is effected in a range of about 60 degrees at the fore and aft of the top dead point. In accordance with the increase of valve lift, the pressure port B is closed and the atmospheric port C is open to fill the cylinder with atmospheric air. In approaching to the bottom dead point, the atmospheric port C is closed and the pressure port B opens again for the super-charging, which is carried on for a range of some 70 degrees until B is closed after the bottom dead point to complete the operation.

In calculation, the quantity of super-charge air i.e. the capacity of blowers, in the ordinary super-charging system is about 1.4—1.6 times of the required cylinder volume at atmospheric pressure, but by using these special valves it was reduced to 0.7 times, which means a reduction of about one-half of volume; consequently power required for driving the blowers became only 4 per cent of the main engine's brake horse-power. The super-charging blowers are of Roots' type as shown in Fig. 11, two sets of them being fitted to the back of the engine and driven by roller chains, as shown in Fig. 12.

Thus the size of the blowers being considerably reduced and its axle having a number of the proper twisting oscillation so high as 4,250, the anxiety due to the twisting vibration of the blowers was completely annihilated. The blowers interchange the suction side and the delivery side in accordance with ahead or astern drive of the engine, so that a

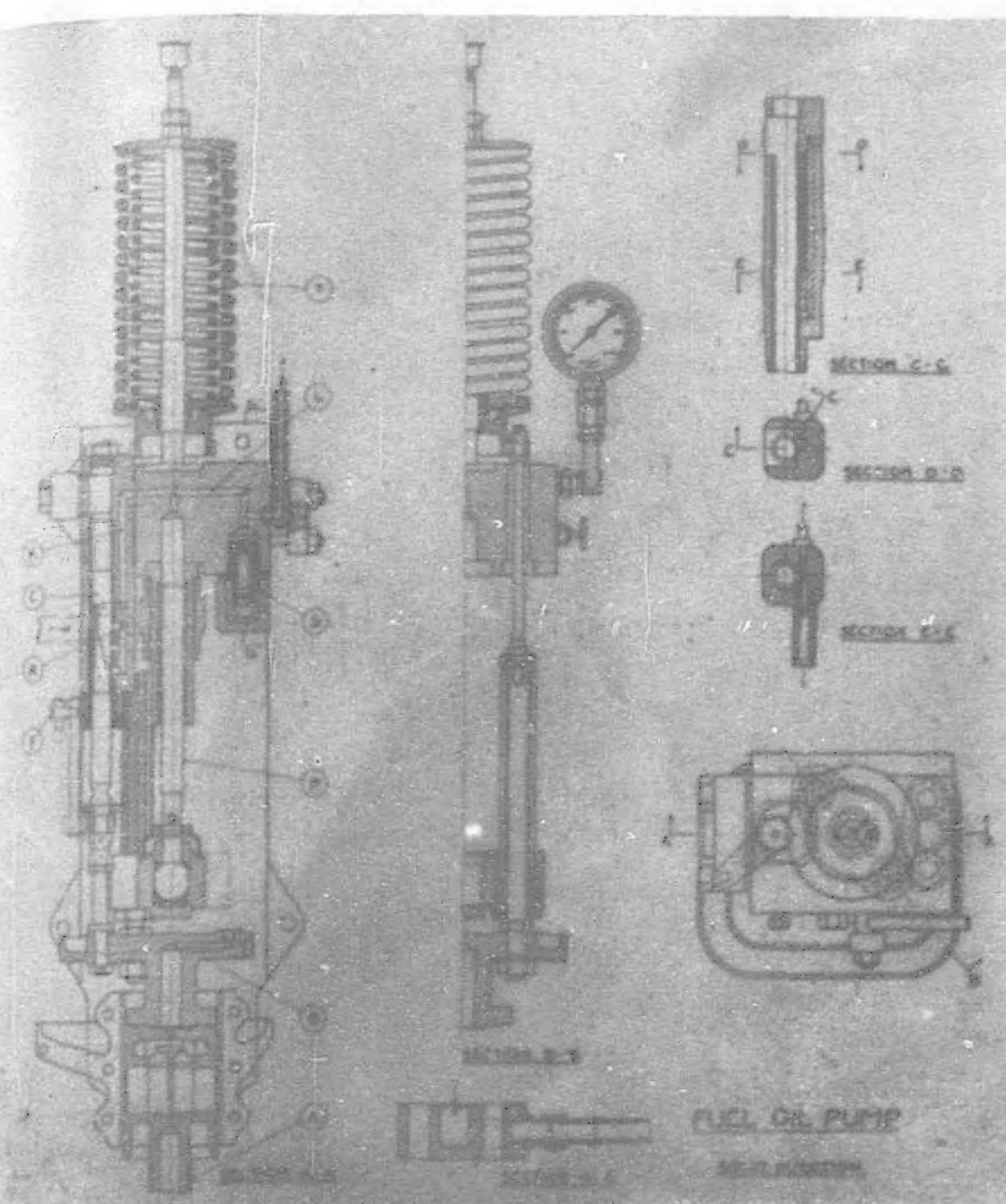


Fig. 5

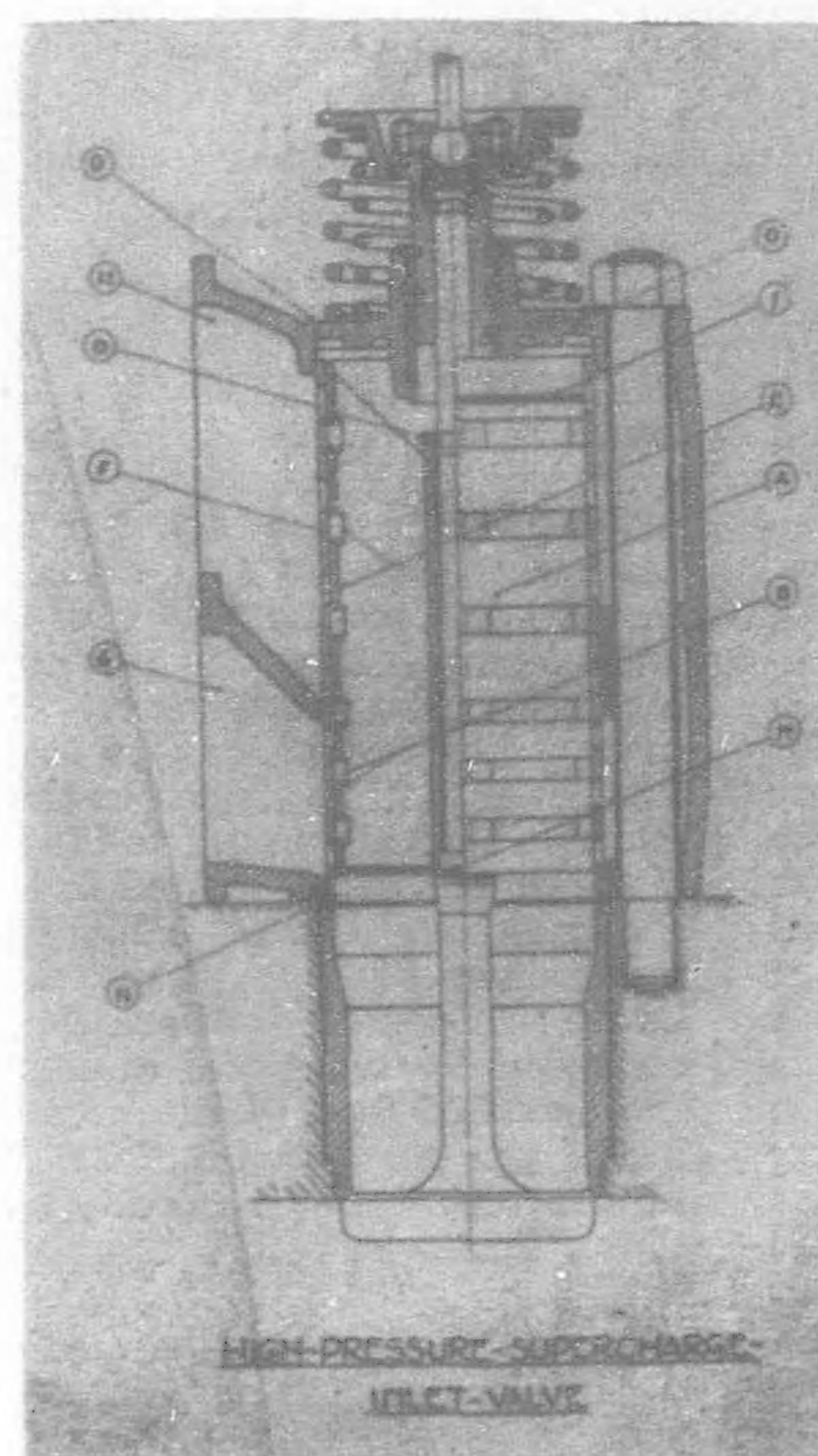


Fig. 6

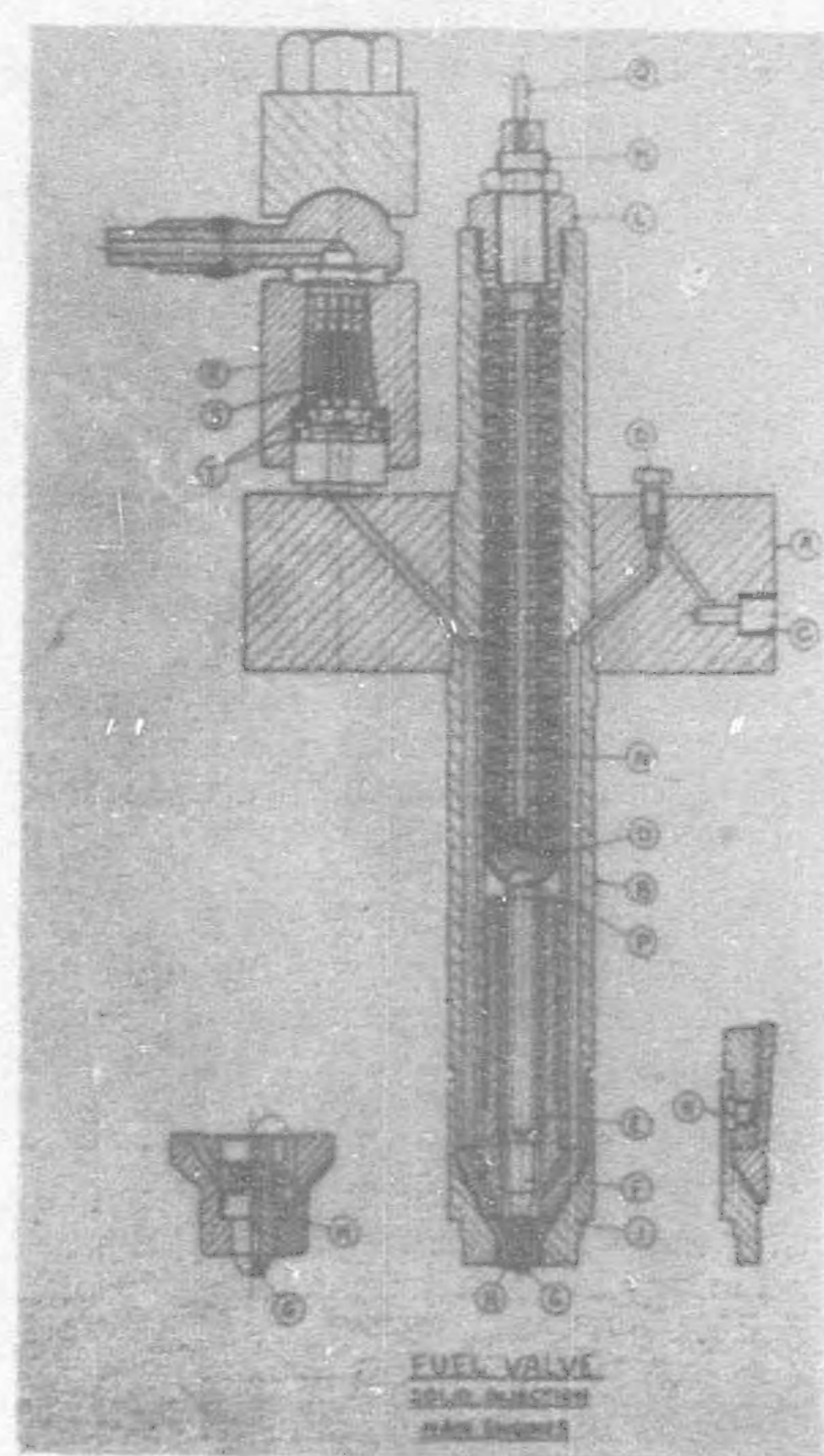


Fig. 8

butterfly valve is fitted as shown in Fig. 11 and is connected to the reversing gear as shown in Fig. 4, so as to automatically interchange the suction and delivery sides at astern or ahead drive. A special device is provided to the blowers for the prevention of noise due to suction air.

### Test Results

Exhaustive shop tests were carried out at the builders' premises. The fuel consumption of 173.8 grams per b.h.p. per hour and mechanical efficiency of 85.23 per cent at full load were recorded, whilst not the slightest trouble has been experienced even at 15 per cent overload at 6,850 b.h.p.

In these tests, the super-charge pressure was regulated at about three meters of water column and the initial pressure at suction stroke was recorded as 2.6 meters.

The back pressure having been about 0.1 atm. which is considerably low as compared with 0.25—0.27 atm. in the ordinary system using exhaust turbines.

Cylinder air at the beginning of compression stroke show a CO<sub>2</sub> content of only 0.25 per cent, which shows very effective scavenging.

It is noteworthy that this engine, in every respect, is not in the slightest inferior to the double-acting two-stroke engine of similar output, but has many advantages in the simplicity of construction, the easiness of handling with less liability for engine troubles.

N.B.—This article is prepared from material supplied by Mr. Y. Okamoto, chief engineer of the Mitsui Tama Works, and follows mainly his paper read before the Society of Naval Architects of Japan, 1931.

## The Training Diesel Tug "Yayoi Maru"

(Continued from page 194).

250 litre air reservoirs at 42 kgs. per sq. cm. In actual experiments, it was possible to operate the engine two or three times at an air pressure of from 34 kgs. to 10 kgs., using only one air reservoir, while the engine failed to start at 9 kgs. of air pressure.

It is interesting to note that the adoption of petrol or semi-Diesel engines for smaller craft such as tugs, fishing boats, launches, etc., has been quite popular for over thirty years, but the pure dieselization of this class of vessels has now become almost exclusive in Japan. The Mitsubishi Kobe Dockyard has endeavored for many years to produce the most suitable engines for such purposes and now has completely standardized the types and capacities to meet various marine requirements. All engines are of four-cycle airless-injection trunk-piston type as installed in the *Yayoi Maru*, but the number of cylinders varies from two to six and the output from 50 to 410 b.h.p. A reversing change gear is fitted to the engines with five or less number of cylinders, whilst for those with six or more cylinders which are self-reversible, a friction clutch is provided to the main shaft.

The builders carried out various experiments with a steel tug *Kasamatsu Maru* owned by themselves, which was originally propelled by a steam reciprocating engine of 140 i.h.p. at 150 r.p.m. and later on was converted to a motor tug equipped with a Mitsubishi

Vickers Diesel engine of type RB3 of 150 b.h.p. This ship has the following dimensions:—

Length between perpendiculars	...	...	60-ft. 0-in.
Breadth moulded	...	...	14-ft. 0-in.
Depth moulded	...	...	8-ft. 6½-in.
Gross tonnage	...	...	45 tons.

These dimensions are very similar to those of the *Yayoi Maru*. It is noteworthy that a great improvement has been realized after displacing the steam engine by the Diesel, as shewn in the following results:—

### RESULT OF SPEED TRIAL

	Output.	R.P.M.	Speed, knots	Displacement
Before conversion	141 i.h.p.	150	8.220	82.0 tons.
After	180 b.h.p.	378	8.646	73.0

### RESULT OF TOWING TEST

	Output.	R.P.M.	Towing power in tons.
Before conversion	144 i.h.p.	125	2.214
After	178 b.h.p.	324	2.500

# Engineering Notes

## INDUSTRIAL

MAGNITOGORSK MILL READY.—The first blast furnace of the Magnitogorsk steel mill in the Urals was completed on January 9. Since the water system, power plant, air-blowers, coke ovens, ore mines and railroad line had been previously completed, the full cycle of production was begun. A committee of experts and government officials went over the furnace, tested the mechanical equipment and declared it ready for operation. The second furnace is also nearing completion. The first battery of ovens at the coke and chemical works was put into operation at the end of December. It produced 271 tons of coke on January 3 and 500 on January 5. The Magnitogorsk mill, which is being designed for a capacity of 2,600,000 tons of pig iron, will be the largest in Europe and the second largest in the world. Houses with dwelling space totaling 18,000 square meters have been completed at Magnitogorsk. A large hospital was opened and a factory kitchen with a capacity of 40,000 meals daily.

OIL IN SAKHALIN.—Result of production for the first eleven months of 1931 indicate that the Sakhalinneft (Sakhalin Oil Trust) fulfilled its program only 50 per cent. This year the trust is to produce 500,000 tons of oil, and next year 1,200,000 tons.

A geological expedition at work in the central part of Sakhalin Island has discovered new deposits 30 kilometers from the shores of the Sea of Okhotsk. Oil had hitherto been found only along the eastern and western coast of the island, and it was believed that central section contained none. The new deposits are similar to those in the Okha fields. During 1932 the Oil Institute expects to send a larger geological group to make a more thorough study of them.

## RAILWAYS

NEW JAPANESE RAILWAY.—The long dream of the people of Izu Province in Japan for a railway line to connect Atami with Ito will be realized in the near future as the Railway Office has recently decided to extend one of its own lines to the southernmost part of the locality. With an expenditure of Y.5,000,000 appropriated for the purpose the construction work for the new railway line from Atami to Ito, a distance of 17 kilometers, will be started at the middle of March, 1932, and is to be completed in the spring of 1937. Much difficulty is expected in the construction of the line as there are two large tunnels and many minor ones to be opened up. A large tunnel must be dug at a point between Usami and Ajiro, and another between Atami and Taga. Six stations are expected to be built along the railway line, namely, at the entrance of the Tunnel, at the foot of the Atami Plum Forest, and each at Taga, Ajiro, Usami and Ito.

## AVIATION

CHINESE AIR LINES.—The Eurasia Aviation Corporation is making preparations for the inauguration of the new air service between Nanking and Sianfu in Shansi. The planes operating this service will make stops at Hsuehchow, Chengchow and Loyang. Under instructions of the Ministry of Communications the Nanking-Loyang section of this new air route will be put into operation first and immediately in order to facilitate communication between Nanking and the capital. A definite route for the Shanghai-Sinkiang airmail and passenger service has been chosen by the Eurasia Aviation Corporation. The route to be traversed, it is learnt, will be via

Nanking, Hsuehchow, Sian, to Kansu and thence to Sinkiang. This will replace the other alternative route which is through Peking, Suiyuan and Kansu. Preparations are reported to be under way for the early inauguration of the service.

## SHIPPING

JAPANESE SHIPPING HIT.—Comparative figures for 1931 and 1930, showing the market fall in the volume of freight carried by Japanese steamers last year from Japan to China, as a result of the anti-Japanese boycott in China, are now available. They are: (all in tons).

	1931	1930
January ..	31,649	35,841
February ..	32,037	34,562
March ..	37,485	37,995
April ..	34,802	31,313
May ..	34,312	27,831
June ..	32,724	38,385
July ..	50,516	38,812
August ..	31,536	34,676
September ..	23,220	30,989
October ..	13,573	45,007
November ..	13,251	54,943
December ..	12,931	55,600
	348,141	455,954

Figures for the last six years stand as follows:

1926 ..	468,317
1927 ..	414,790
1928 ..	491,964
1929 ..	511,395
1930 ..	455,954
1931 ..	348,141

# SULZER BROTHERS

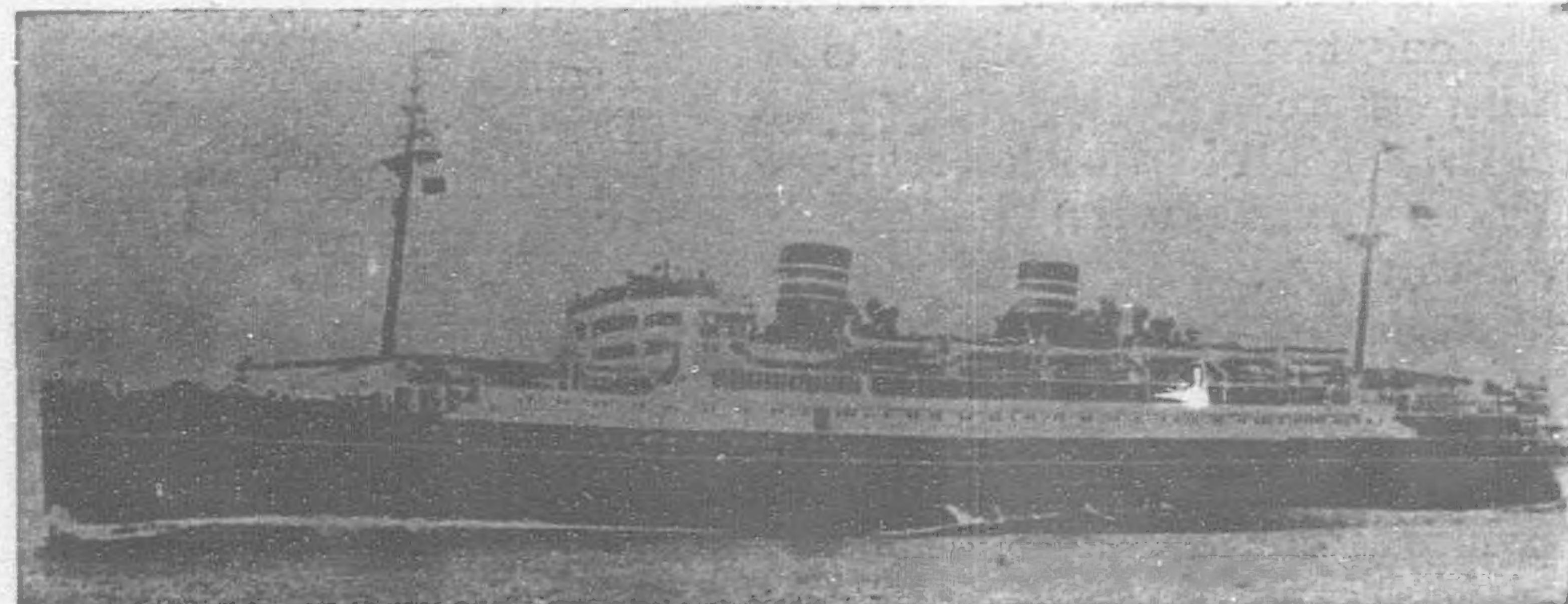
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